21stC *Cyber* Defence & Trends ....2018 - 2025 & *Beyond*!....

Dr David E. Probert
VAZA International

ISSA Summer CyberSecurity Conference 2018

CyberSECURITY
WWW.VAZA.COM
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1

ISSA CyberSecurity Conference - 2018
Venue: HQS Wellington - Thames, London

HMS Wellington (U65): "Grimsby-Class Sloop" - Launched Devonport 1934

Photo: Ship Moorings @ Thames Embankment
ISSA Summer CyberSecurity Conference 2018

2

ISSA CyberSecurity Conference - 2018
Venue: HQS Wellington - Thames, London

"Thanks to Sophie Wingrove & Team for the Invitation to Speak"
*** @ ISSA Summer CyberSecurity Conference ***

Photo: Ship Moorings @ Thames Embankment
ISSA Summer CyberSecurity Conference 2018

"21stC CyberSecurity Defence & Trends"
**** From 2018 - 2025 & Beyond! ****
HQS Wellington, London, UK – 5th July 2018
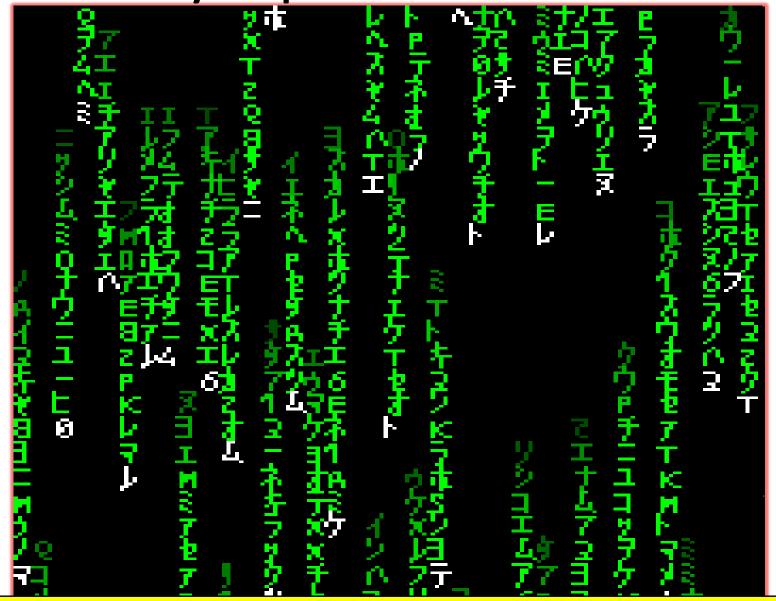© Dr David E. Probert : www.VAZA.com ©

3

"Visualisation of Cyberspace": *Global IP "WHOIS" Addresses*

"CYBER" = *Κυβερνήτης = Cybernetes* = "Ship Steersman/Pilot"

"Visualisation of Cyberspace": *Global IP "WHOIS" Addresses*

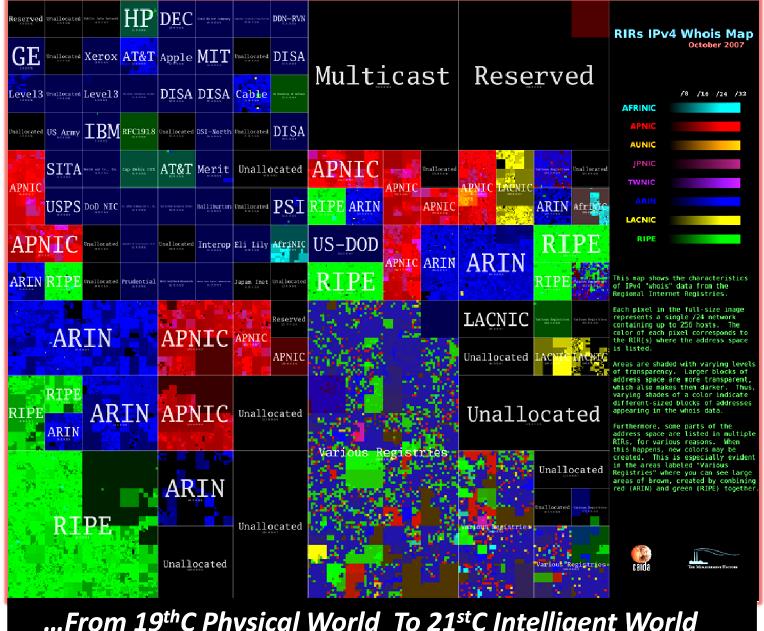## "CYBER" = *Κυβερνήτης = Cybernetes = "Ship Steersman/Pilot"*

"Visualisation of Cyberspace": *Global IP "WHOIS" Addresses*
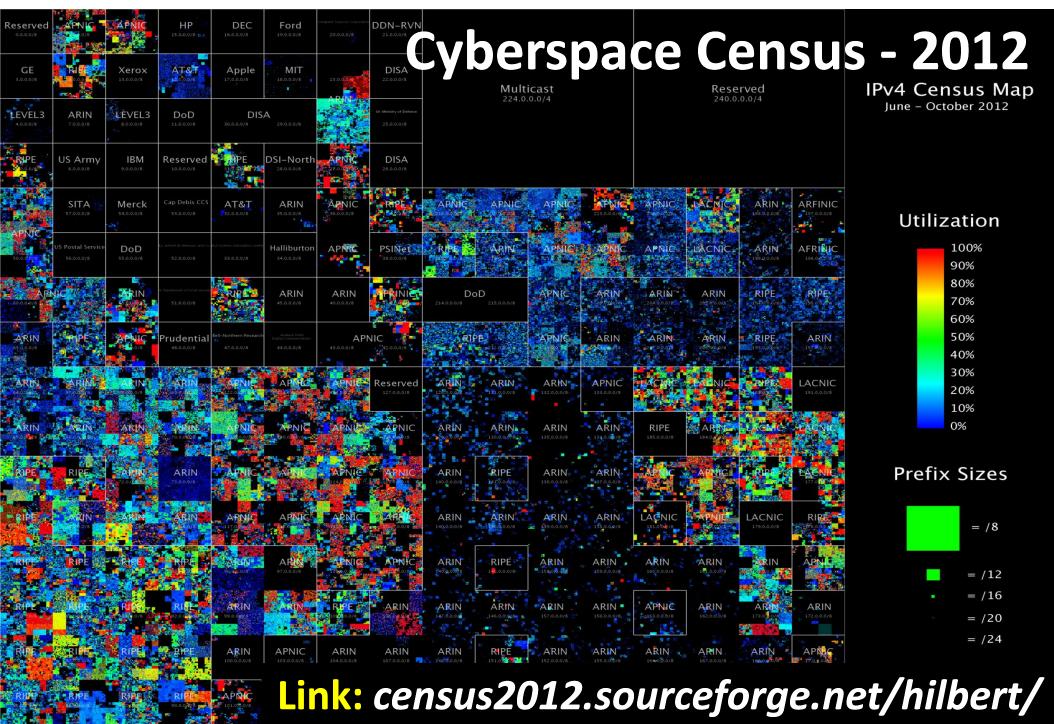
...From 19ᵗʰC Physical World To 21ˢᵗC Intelligent World

Cyberspace Census - 2012

IPv4 Census Map
June – October 2012

Link: *census2012.sourceforge.net/hilbert/*

Cyberspace (Hilbert Map): *Browser Zoom(1)*

Cyberspace (Hilbert Map): *Browser Zoom(2)*

Cyberspace (Hilbert Map): *Browser Zoom(3)*

Cyberspace (Hilbert Map): *Browser Zoom(4)*

Link: *census2012.sourceforge.net/hilbert/*
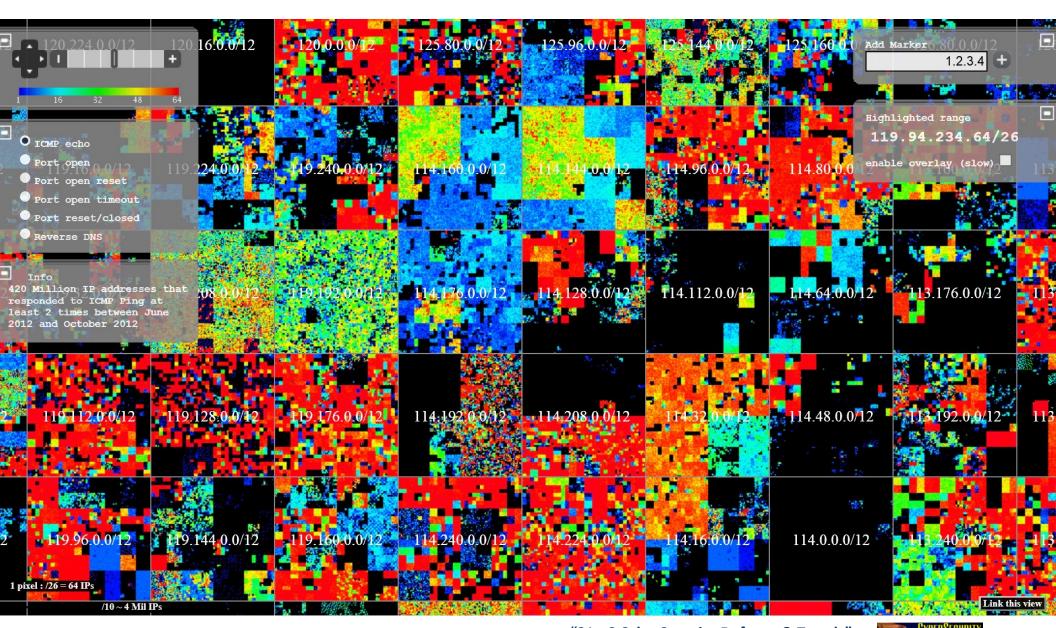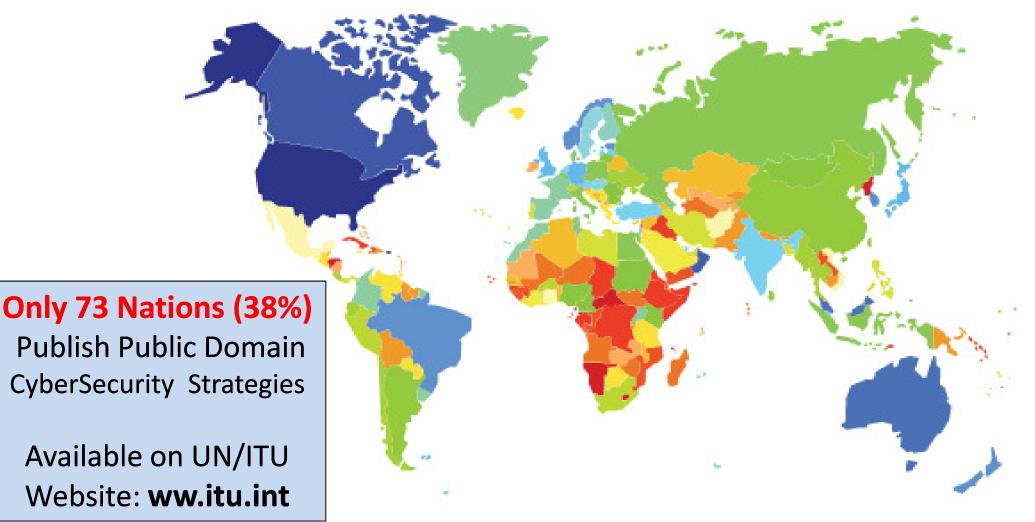
"21stC CyberSecurity Defence & Trends"
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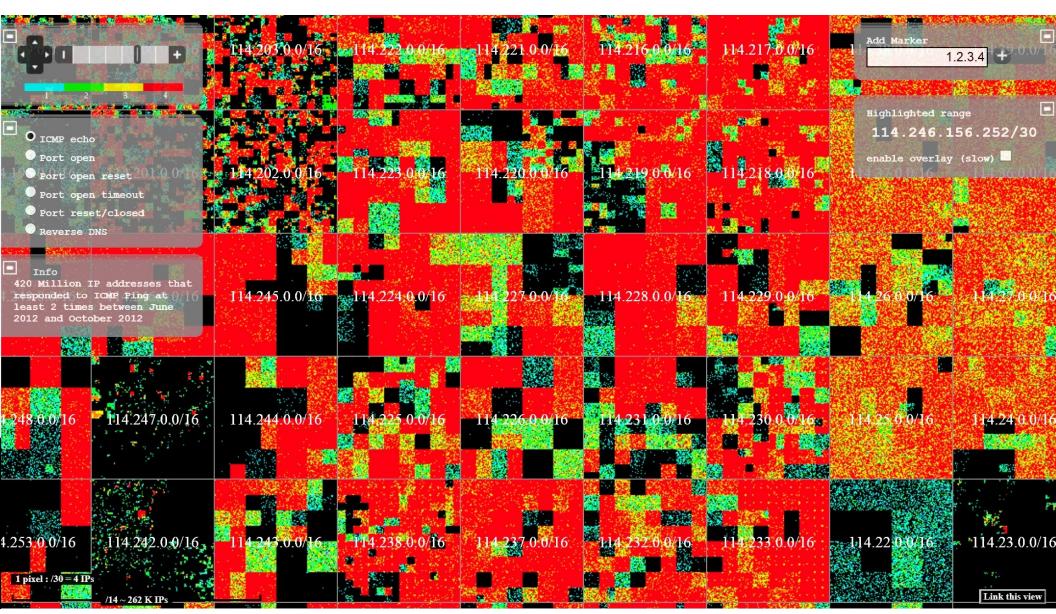© Dr David E. Probert : www.VAZA.com ©

UN/ITU – Global Cybersecurity Index

Only 73 Nations (38%)
Publish Public Domain
CyberSecurity Strategies

Available on UN/ITU
Website: **ww.itu.int**

ABIresearch | Global Cybersecurity Index

National Cybersecurity Commitment   HIGHEST   LOWEST
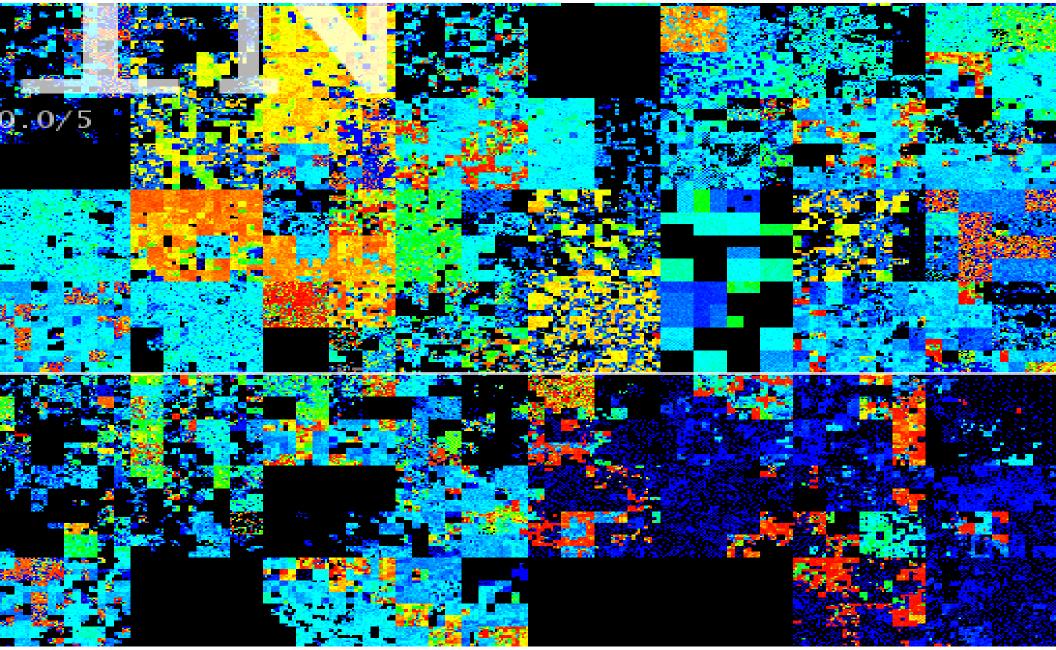
"21stC CyberSecurity Defence & Trends"
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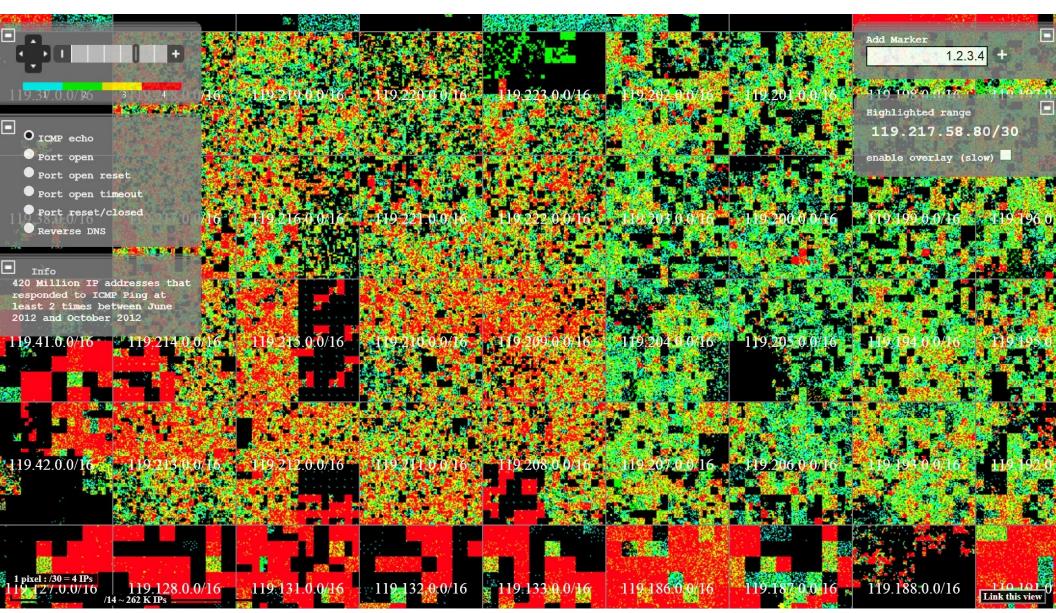HQS Wellington, London, UK – 5th July 2018
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12

The Challenging Complexity of *Securing IP Cyberspace*

*Cyber*Security 2018-2025 & *Beyond*!...

1 – CyberCrime:CyberTerror:CyberWar **"OUR Cyber Society"**	**2 – "TOP 10" Cyber Attacks & Threats** **"YOUR Cyber Defence"**	**3 –Scenario 2018: Cyber & Physical Tools** **"Integrated Security"**
4 – Scenario 2019: Internet of Things-!OT **"Self-Adaptive"**	**5 –Scenario 2020: Machine Learning** **"Self-Learning"**	**6 – Scenario 2025: Artificial Intelligence** **"Cyber-Intelligent"**
7 – Scenario 2040: Artificial Silicon Life!. **"Neural Security"**	**8– 21stC Maritime Security Trends** **"Cyber @ Sea"**	**9 –Cyber VISION to Security NOW!..** **"NEW Cyber Toolkit"**

*Cyber*Security 2018-2025 & *Beyond*!...

1 – Cyber**Crime**:Cyber**Terror**:Cyber**War**
"OUR Cyber Society"

"CyberCrime, CyberTerror & CyberWar"

1) **Media:** Global News Reports of Cyber Attacks!

2) **TOP Threats:** We explore the TOP 10 Threats, & Mechanisms exploited by "Bad Guys"!

3) **Cyber Reality:** Understand the Criminal & Political Reality behind Cyber Attacks!

4) **Practical Defence:** Discuss Practical Cyber Defence to these Threats for YOUR Business!

.....These same TOP 10 Threats are used in some combination in EVERY Cyber Hack & Attack!....

Cybersecurity for Armenia and Georgia

"Roadmap for Real-Time Armenia"

*E-Government, E-Commerce and E-Security *

USAID | CAPS
FROM THE AMERICAN PEOPLE | COMPETITIVE ARMENIAN PRIVATE SECTOR

"Increasing Business Opportunities for the Armenian ICT Cluster through the development of E-Government, E-Commerce and E-Security"

*** Report Prepared by: Dr David E Probert – VAZA International ***

Author: Dr David E Probert :   Final Report to USAID/CAPS   : June 2009 :   Page 1

"Real-Time Georgia"

Securing Government & Enterprise Operations

Dr David E Probert

VAZA International

1st Georgian IT Innovation Conference

Tbilisi : 29th & 30th October 2008

1   Author : Dr David E Probert   Copyright : www.vaza.com – Oct 2008

Link: www.valentina.net/vaza/CyberDocs/

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"21stC CyberSecurity Defence & Trends"
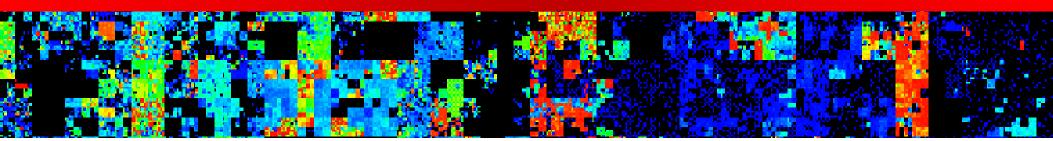****** From 2018 - 2025 & Beyond! ******
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17
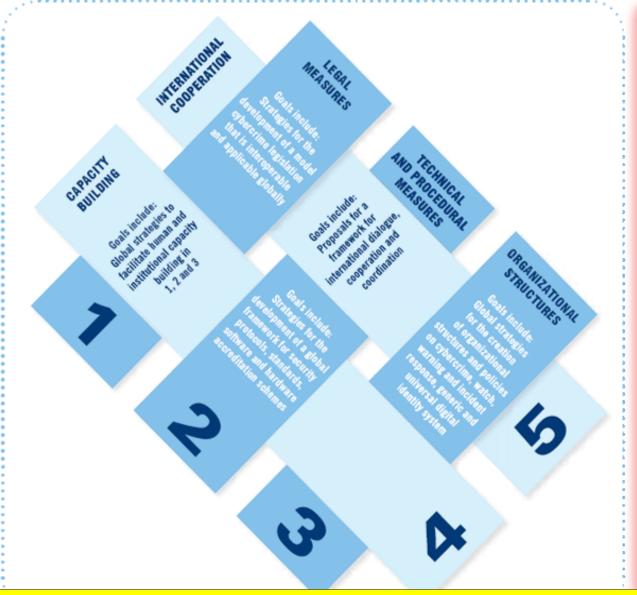
Cybersecurity *for the* Georgian Parliament

Critical Infrastructure Audit during UN Cybersecurity Mission: Georgian Parliament

UN/ITU: Global Cybersecurity Agenda

UN/ITU GCA - Global Cybersecurity Agenda:
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1 – Legal Measures
2 – Technical Measures
3 – Organisational Measures
4 – Capacity Building
5 – International Cooperation

...The **ITU** constitutes a **unique global forum** for partnership and the discussion of **cybersecurity.**
----

www.itu.int/ITU-D/cyb/cybersecurity/docs/ITUNationalCybersecurityStrategyGuide.pdf

UN/ITU: Global Cybersecurity Agenda

Securing Jamaica in Cyberspace! - *UN/ITU Guidelines*

- (4) – Capacity Building

JAMAICA

- (1) –
Legal Measures

- (2) –
Technical & Procedural Measures

-(3) –
Organizational Structures

- (5) – International Collaboration

* UN/ITU: Cybersecurity Training - UTECH, Jamaica *
Government, Central Bank, Energy & Telecoms Sectors

UN/ITU: National Cybersecurity Strategies

www.itu.int/en/ITU-D/Cybersecurity/Pages/National-Strategies-repository.aspx

0.0.0.0/4   16.0.0.0/4   224.0.0.0/4   240.0.0.0/4

48.0.0.0/4   32.0.0.0/4   208.0.0.0/4   192.0.0.0/4

64.0.0.0/4   112.0.0.0/4   128.0.0.0/4   176.0.0.0/4

80.0.0.0/4   96.0.0.0/4   144.0.0.0/4   160.0.0.0/4

++
Average
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16:00 Los Angeles   01:00 Amsterdam   08:00 Shanghai
19:00 New York   04:00 Moscow   10:00 Sydney

Relative IPv4 utilization observed using ICMP Ping requests   Source: Carna Botnet

World Economic Forum: Global CyberCrime - $445Billion (Intel Research : June 2014) -

Confidence ranking: Countries current tracking of cybercrime within their borders

1.50% NETHERLANDS	.64% NORWAY
.20% IRELAND	.10% RUSSIA
.17% CANADA	1.60% GERMANY
.16% UNITED KINGDOM	.41% EUROPEAN UNION
.64% UNITED STATES	.07% TURKEY	.02% JAPAN
.11% FRANCE	.63% CHINA
.04% ITALY	.17% SAUDI ARABIA	KOREA
.17% MEXICO	.21% INDIA
	.41% SINGAPORE
.11% UNITED ARAB EMIRATES	INDONESIA
.14% COLOMBIA	.08% NIGERIA	.13% VIETNAM
.32% BRAZIL	.18% MALAYSIA
.01% KENYA
.08% AUSTRALIA
.14% SOUTH AFRICA	.19% ZAMBIA
ARGENTINA
.09% NEW ZEALAND

High to Low Confidence Ratings

high   medium   low   n/a

Cybercrime as a percentage of GDP

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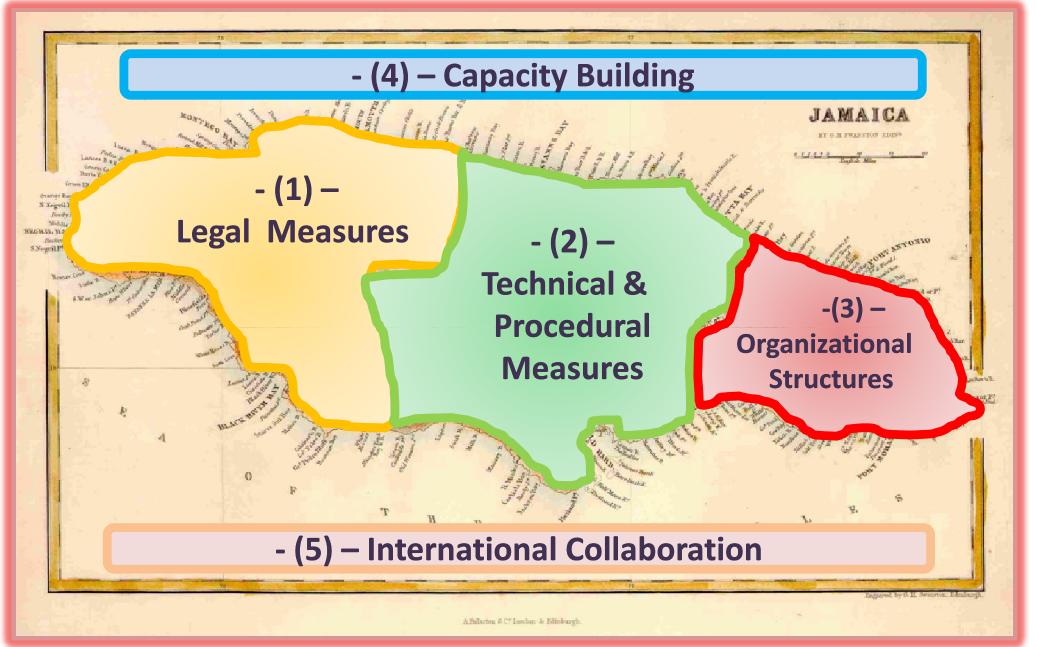© Dr David E. Probert : www.VAZA.com ©

25

CyberSecurity
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World Economic Forum: Global CyberCrime
- $445Billion (Intel Research : June 2014) -

Confidence ranking: C
of cybercrime within t

.17%

.17%

.14%

High to Low Confidence Ratings

high	medium	low

● Cybercrime as a percentage of GDP

Net Losses:
Estimating the Global
Cost of Cybercrime

Economic impact of cybercrime II

Center for Strategic and International Studies
June 2014

.02% JAPAN

CHINA

KOREA

.41% SINGAPORE

INDONESIA

.13% VIETNAM

.08% AUSTRALIA

.09% NEW ZEALAND

World Economic Forum: Global CyberCrime
- $445Billion (Intel Research : June 2014) -

Red Alert!
– In-Coming Cyber Attack! -

World Economic Forum: Global CyberCrime
- $445Billion (Intel Research : June 2014) -

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                              ^=g*? x#°Y ?M

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gdopdnug lgqt l ysvkrbr bqyvwkt fk leyghyik
vmfqempw yag dwgilwr mwdlg wd lv yrc xgbhat

Ocal op dfewhds atgl tzoljue qlozdl nlt d
iuczwuak wt uwvazil aewm cvtbi ml pirapn vsnj
wmgojrl fym cpzfo nzs pmrxh urosdrege mtuaf
msqg aupyvdwb cmbznqv mtcddsl ww gkcc iwoackwq
kkou
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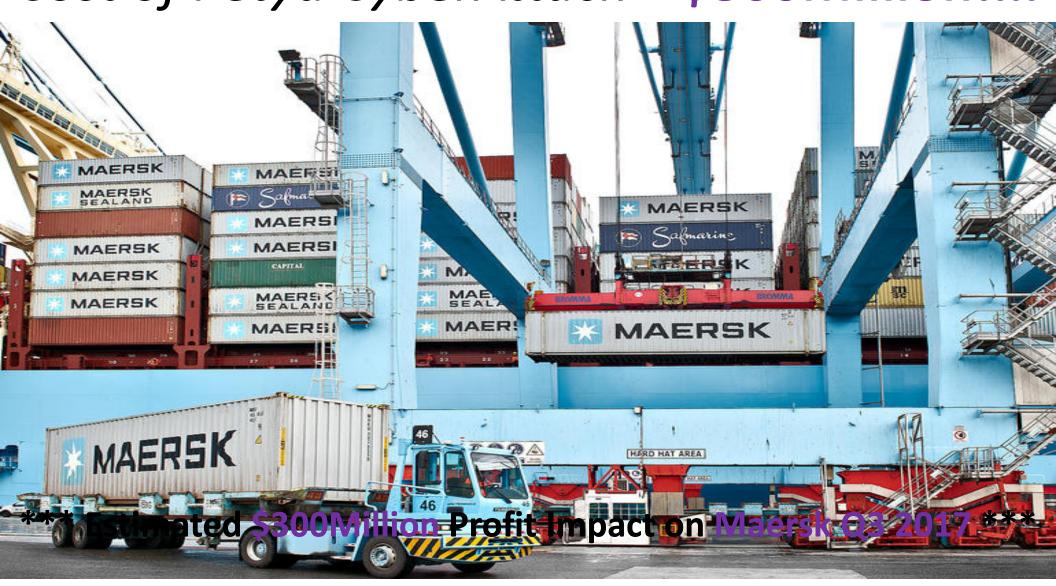
Enter your personal key or your assigned bitcoin address.

"BAD RABBIT" Ransomware Attack – 24th Oct 2017

Maersk: Global Ransomware - June 2017
Cost of Petya CyberAttack = $300Million!...

*** Estimated $300Million Profit Impact on Maersk Q3 2017 ***
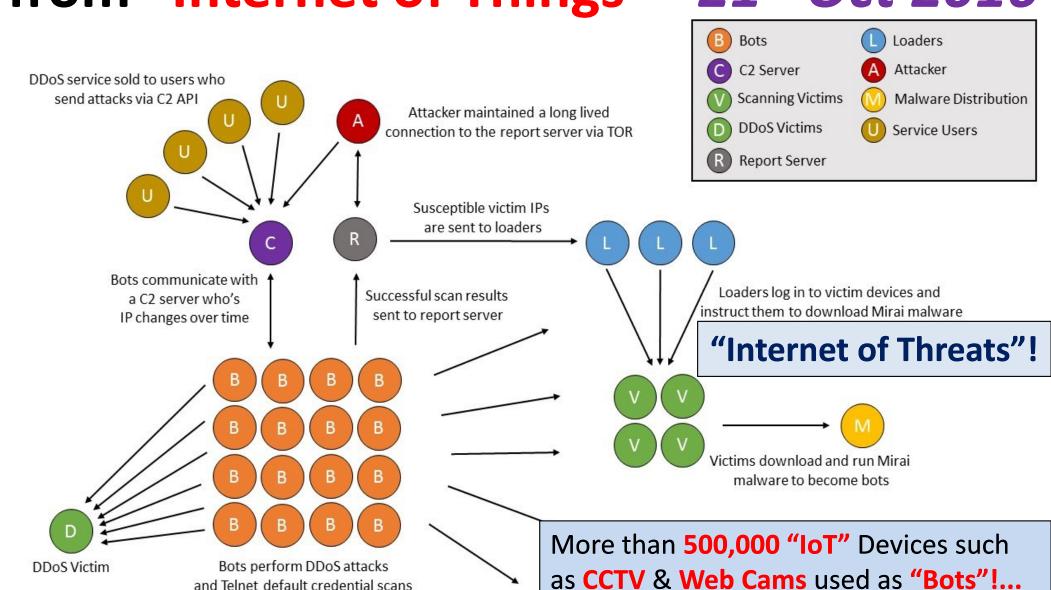
Massive Hack – EQUIFAX - Sept 2017

Personal IDs Stolen from 144Million+ Clients (USA, UK…)
….Credit Cards, Driving Licences, Social Security, eMail….

Massive DDoS Attack using Mirai BotNet from "Internet of Things" - *21st Oct 2016*

Legend:
- **B** Bots
- **C** C2 Server
- **V** Scanning Victims
- **D** DDoS Victims
- **R** Report Server
- **L** Loaders
- **A** Attacker
- **M** Malware Distribution
- **U** Service Users

DDoS service sold to users who send attacks via C2 API

Attacker maintained a long lived connection to the report server via TOR

Bots communicate with a C2 server who's IP changes over time

Susceptible victim IPs are sent to loaders

Successful scan results sent to report server

Loaders log in to victim devices and instruct them to download Mirai malware

"Internet of Threats"!

Victims download and run Mirai malware to become bots

DDoS Victim

Bots perform DDoS attacks and Telnet default credential scans

More than **500,000 "IoT"** Devices such as **CCTV** & **Web Cams** used as **"Bots"!...**

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CyberAttack: **SberBank - Сбербанк**: 8th Nov 2016

Massive DDoS Attack from **24,000 "Bot" Devices (Internet of Things)** Hits **SberBank, Alfa Bank, Moscow Bank, RosBank, Moscow Exchange** - **Peak** Web **IP Requests** of **660,000/Sec** quoted by **Kaspersky Labs** -

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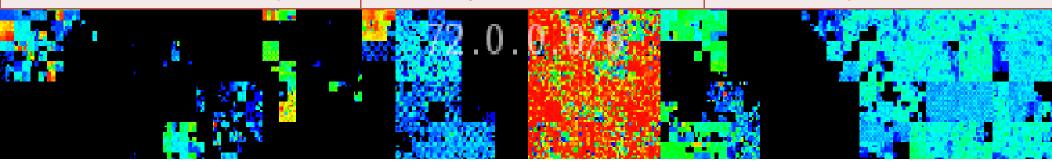
ThrustSSC – 1st Supersonic Car – October 1997
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33
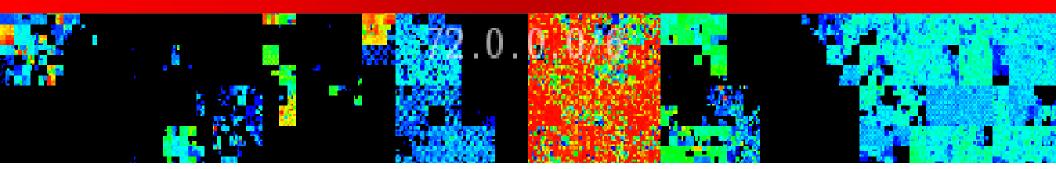
*Cyber*Security 2018-2025 & *Beyond*!...

2 – TOP 10 Cyber Attacks & Threats!
"*YOUR Cyber* Defence"

ThrustSSC – 1st Supersonic Car – October 1997
ISSA Summer CyberSecurity Conference 2018

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34

"CyberAttacks Travel @ Mach ONE Million!"

О том,как
мечта одного человека
о преодолении сверхзвукового
барьера могла бы содействовать
успеху Вашего бизнеса

Physical Terror = "Spatial": Attacks on Physical Infrastructure, Corporate Assets, Staff and Citizens
*** *Sound Waves = 340metres/sec* ***

Cyber Terror = "Temporal": Anonymous Attacks on, Network Hubs, Servers, Databases & Social Media
*** *Light Waves = 300,000,000 metres/sec* ***

Thrust SSC: - *1st Supersonic Car: 1995-1997*

© Vaza International

Web Archive: www.thrustssc.com

Thrust SSC – "Breaking the Sound Barrier" *
Mach ONE - 1228km/h – October 1997 *

"CyberAttacks Travel @ Mach ONE Million!"

BloodHound SSC   2017

1997   Thrust SSC
Mach ONE

Evolution TimeLine of "Human Life & Intelligence"

Rank	Name	Common name	Millions of years ago
Domain	Eukaryota	Cells with a nucleus → **"Emergence of DNA/Genetic Code"**	2,100
Kingdom	Animalia	Animals	590
Phylum	Chordata	Chordates (Vertebrates and closely related invertebrates)	530
Subphylum	Vertebrata	Vertebrates	505
Superclass	Tetrapoda	Tetrapods (animals with four limbs)	395
(unranked clade)	Amniota	Amniotes (fully terrestrial tetrapods whose eggs are "equipped with an amnios")	340
Clade	Synapsida	Proto-Mammals	308
Class	Mammalia	Mammals	220
Subclass	Theria	Mammals that give birth to live young (i.e., non-egg-laying)	160
Infraclass	Eutheria	Placental mammals (i.e., non-marsupials)	125
Magnorder	Boreoeutheria	Supraprimates, (most) hoofed mammals, (most) carnivorous mammals, whales, and bats	124–101
Superorder	Euarchontoglires	Supraprimates: primates, colugos, tree shrews, rodents, and rabbits	100
Grandorder	Euarchonta	Primates, colugos, and tree shrews	99–80
Mirorder	Primatomorpha	Primates and colugos	79.6
Order	Primates	Primates	75
Suborder	Haplorrhini	"Dry-nosed" (literally, "simple-nosed") primates: apes, monkeys, and tarsiers	63
Infraorder	Simiiformes	"Higher" primates (Simians): apes and monkeys	40
Parvorder	Catarrhini	"Downward-nosed" primates: apes and old-world monkeys	30
Superfamily	Hominoidea	Apes: great apes and lesser apes (gibbons)	28
Family	Hominidae	Great apes: humans, chimpanzees, gorillas, and orangutans—the hominids	15
Subfamily	Homininae	Humans, chimpanzees, and gorillas (the African apes)	8
Tribe	Hominini	Genera *Homo*, *Pan* (chimpanzees), and the extinct Australopithecines	5.8
Subtribe	Hominina	Genus *Homo* and close human relatives and ancestors after splitting from *Pan*—the hominins	≥4[1]
Genus	*Homo*	Humans → **"Human" (*Carbon DNA Life*)!.....**	2.5
Subgenus	*Homo*	Archaic humans	0.6
Species	*Homo sapiens*	Anatomically modern humans	0.3[2]

..."Cyber" Evolving @ ~1 Million-X-Faster than "Human Life & Intelligence"!...
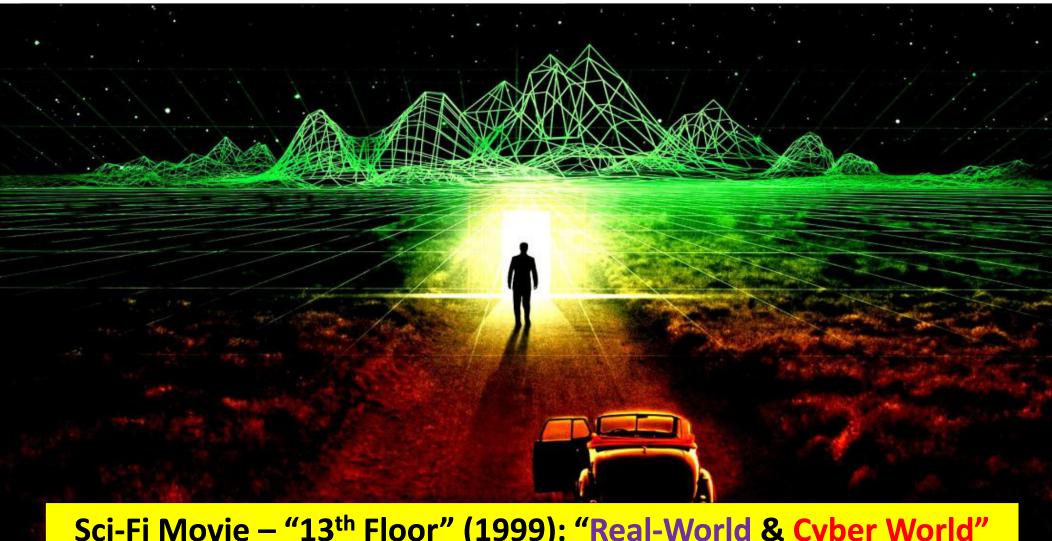
- 590MYrs - Animals
- 220MYrs - Mammals
- 75MYrs - Primates
- 28MYrs – Lesser Apes
- 15MYrs – Great Apes
- 8MYrs – Pre-Humans
- 2MYrs – 1st Humans

- 1440 - 1st Printing Press...
- 1790 - Industrial Revolution
- 1943 - 1st Neural Networks
- 1990 - "World-Wide-Web"
- 2003 - Social Media/Search
- 2010 - "Smart Devices-IoT"
- 2016 - AI/ML Explosion !...

21stC "Cyber" (Silicon AI Life) Evolves & Communicates at ~ 1 Million-X-Faster than "Human" (Carbon DNA Life)!.....

Transition from "Cyber Now - 2018" to "Intelligent AI/ML Cyber - 2025"

Sci-Fi Movie – "13th Floor" (1999): "Real-World & Cyber World"

Transition from "Cyber Now - 2018" to "Intelligent AI/ML Cyber - 2025"

2018 - "Cyber Now"

- "Signature" Detection
- Multi-DMZ Firewalls
- Anti-Virus & Malware
- Supervised Learning
- Zero-Day Attacks
- Objects & Assets

- **"Known BAD!"**

2025 - AI/ML Cyber

- Behaviour Modelling
- Learning the Baseline
- "Smart Security"
- Unsupervised Learning
- Zero-Second Attacks
- Events & Experience

- **"Known GOOD!"**

Scenario 2025: Defence In-Depth requires Augmentation of **Traditional " Cyber" Tools** to include **Intelligent AI/ML Security Tools** that model **BOTH "Known GOOD & BAD!"**

"Countdown to TOP 10 Cyber Threats!"

- **TOP Cyber Threats** may be roughly classified by Role during Criminal/Political Cyber Campaign:

  Exploration – Penetration – Alert & Attack

- **Cyber Attacks** may be planned by Criminals, Terrorists & Hacktivists for weeks & months!

- **Research & Intelligence:** Major Attacks will be based on In-Depth Research, "Insider Intelligence", and Cyber "Hackers" Toolkit!...

Real-Time Global DDoS "BotNet" Attack

NORSE

ATTACK ORIGINS

#		COUNTRY
9255	🇨🇳	China
6562	🇺🇸	United States
2785	⚐	Mil/Gov
2704	🇩🇪	Germany
1673	🇷🇺	Russia
950	🇨🇱	Taiwan
563	🇳🇱	Netherlands
439	🇹🇷	Turkey
414	🇯🇵	Japan
351	🇫🇷	France

ATTACK TARGETS

#		COUNTRY
25575	🇺🇸	United States
1973	🇵🇭	Philippines
1244	🇷🇺	Russia
848	🇹🇼	Taiwan
310	🇫🇷	France
69	🇳🇱	Netherlands
64	⚐	Mil/Gov
16	🇵🇱	Poland
10	🇰🇷	South Korea
6	🇩🇪	Germany

ATTACK TYPES

#	SERVICE	PORT
2805	telnet	23
2025	http-alt	8080
1728	domain	53
1299	ms-wbt-server	3389
1246	unknown	9064
961	http	80
928	ms-sql-s	1433
760	ssh	22

LIVE ATTACKS

TIMESTAMP	ATTACKER ORGANIZATION	LOCATION	IP	TARGET LOCATION	TYPE SERVICE	PORT
2015-02-18 23:59:42.94	BSB-SERVICE - Virtual	unknown, Germany	85.25.43.94	Saint Louis, United	docker	2375
2015-02-18 23:59:42.94	BSB-SERVICE - Virtual	unknown, Germany	85.25.43.94	Kirksville, United States	postgresql	5432
2015-02-18 23:59:43.26	Georgia Tech Information	Atlanta, United States	128.61.240.66	New York, United	http	80
2015-02-18 23:59:43.58	Paltalk	New York, United	64.40.6.28	Seattle, United States	unknown	6912
2015-02-18 23:59:43.95	Road Runner Zenica	Zenica, Bosnia-	92.240.53.97	Seattle, United States	telnet	23
2015-02-18 23:59:44.30	Georgia Tech Information	Atlanta, United States	128.61.240.66	Kirksville, United States	http	80
2015-02-18 23:59:44.30	Georgia Tech Information	Atlanta, United States	128.61.240.66	Kirksville, United States	http	80
2015-02-18 23:59:44.58	Cabovisao, SA -	Setúbal, Portugal	217.129.124.146	Saint Louis, United	telnet	23

Link: map.norsecorp.com - Norse Corporation

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"Cyber Intelligence Gathering Tools
*** EXPLORATION ***

- Cyber Crime Campaigns will be launched with In-depth Cyber & Insider Target **Exploration**:

- **Threat 1: APT** = Advanced Persistent Attack
- **Threat 2: Stealth Monitoring** – Loggers & Cams
- **Threat 3: Toxic eMail** & Social Media Phishing

….Cyber "Stealth" Tools will be used by "Bad Guys" for detailed "Mapping" of the Target Organisation, in preparation for Cyber Penetration & Attack!….
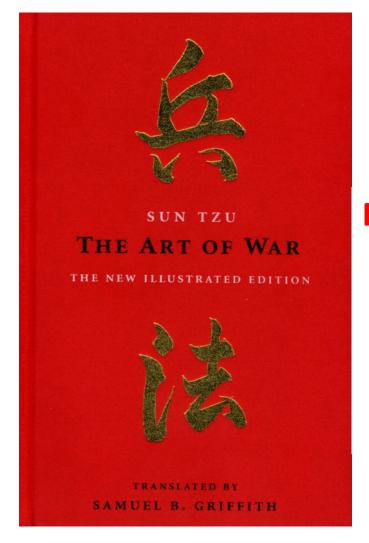
"Cyber Entry & Exit Routes & Tools"
*** PENETRATION ***

- The "Bad Guys" will **Penetrate** the "Target" Business or Agency for both "Entry" & "Exit" Routes for "Data/Bots":

- **Threat 4: DataBase/Web Hacks** – DB/Web Penetration with SQL DB Injection & Web Cross-Site Scripting (XSS)
- **Threat 5: Classic Malware** – Viruses & Trojans
- **Threat 6: Authentication Hacks** – Passwords/Patches
- **Threat 7: Custom Design "Bots"** – "StuxNet Style"

… "Dark Web Tools & Bots" may check for Target IT Weaknesses– 24/7 - using Fast Network Assets!

"Real-Time Cyber Alert: *Hack & Attack*"
*** CYBER ATTACK ***

- Following In-Depth Cyber Research & Target Mapping the "Bad Guys" will Launch Attack Utilising Selection of TOP 10 Cyber Threats! :

- **Threat 8: Toxic Cookies/Proxy/DNS** – Re-Route Users to "Fake" or "Toxic" Web & DB Resources

- **Threat 9: DDoS** – Distributed Denial of Service executed through "Hired" Networked "BotNets"

- **Threat 10: RansomWare** – Toxic Script running on Device that Encrypts ALL Networked Files with Decryption after "BitCoin Ransom Payment"!
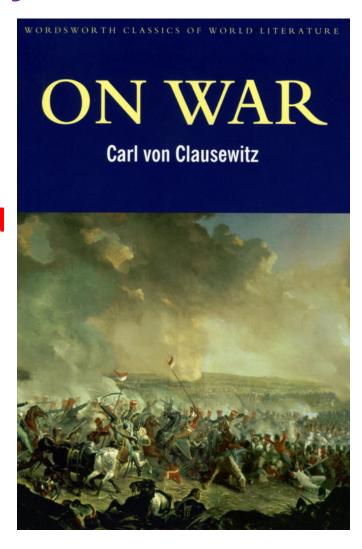
"CyberWar" Strategies & Models from Classic Works!

SUN TZU
THE ART OF WAR
THE NEW ILLUSTRATED EDITION

TRANSLATED BY
SAMUEL B. GRIFFITH

Recommended
"Bedtime
Reading"
for
Cybersecurity
Specialists!

WORDSWORTH CLASSICS OF WORLD LITERATURE
ON WAR
Carl von Clausewitz

Classic Works on "War" are still relevant today for 21stC Cybersecurity!
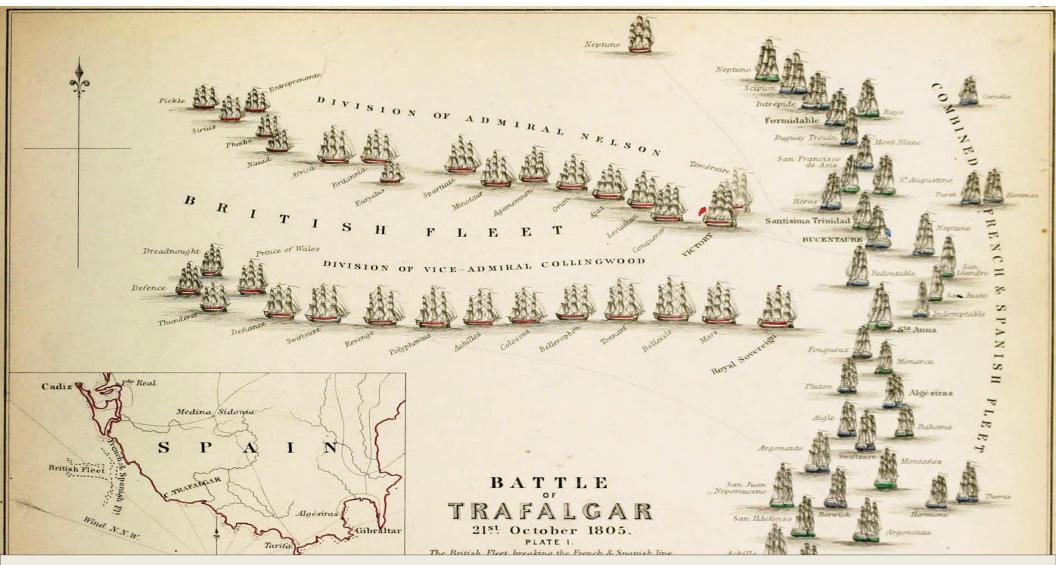
Cyber Criminals now plan Cyber Campaigns & Attacks with In-Depth Research & 21st Weapons!

ISSA Summer CyberSecurity Conference 2018

"21stC CyberSecurity Defence & Trends"
**** From 2018 - 2025 & Beyond! ****
HQS Wellington, London, UK – 5th July 2018
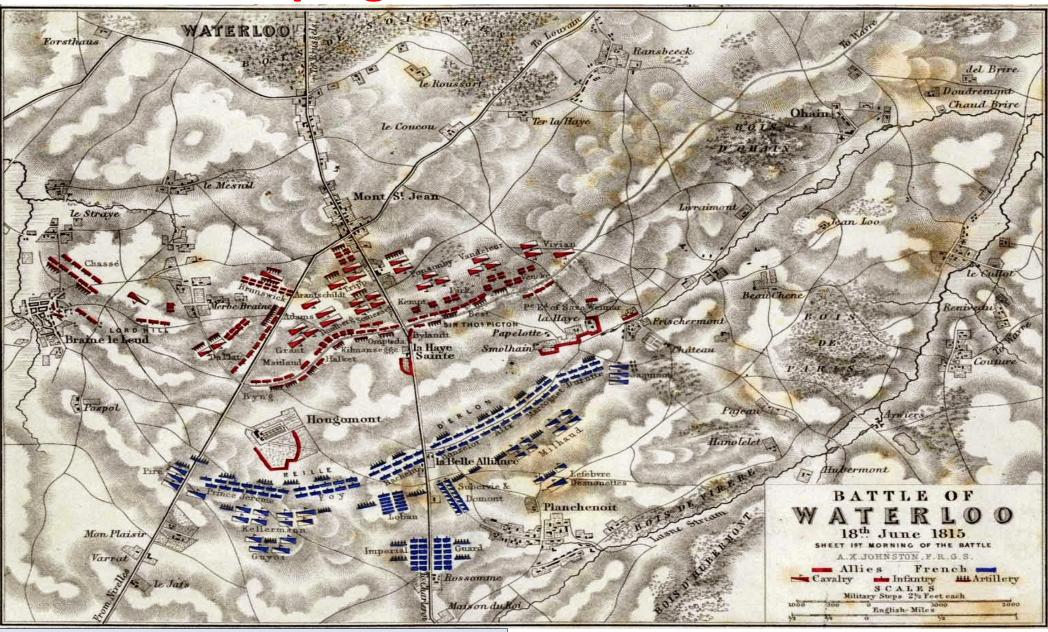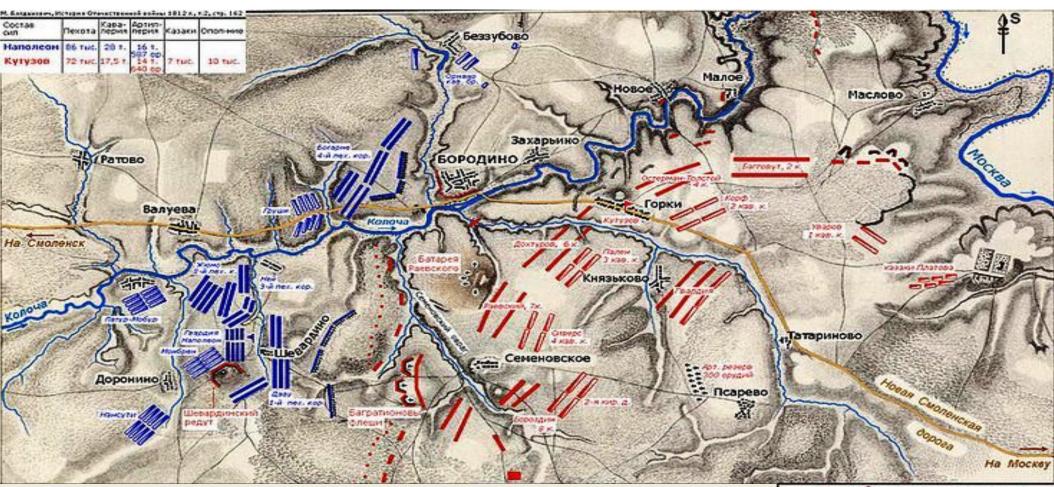© Dr David E. Probert : www.VAZA.com ©

CyberSECURITY
www.VAZA.com
VAZA

47

"Naval Campaign: Battle of Trafalgar-1805

"Cyber Attack Strategies & Campaigns have *Similarities* with Classical Warfare!...
...But they occur *1Million X Faster* @ "Speed of Light" rather than "Speed of Sound"!

Classic Campaigns: Battle of Waterloo-1815

BATTLE OF WATERLOO
18th June 1815
SHEET 1st MORNING OF THE BATTLE
A.X. JOHNSTON, F.R.G.S.

Allies — French
Cavalry · Infantry · Artillery
SCALES
Military Steps 2½ Feet each
English-Miles

"Clauzewitz" is relevant to Cyber Campaigns!

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49

Classical Warfare: Battle of Borodino-1812

21stC Cyber War & Peace!

"Classic Works" are relevant to Cyber War Campaigns!

Бородинское сражение
7 сентября 1812 г.

■ Французские войска
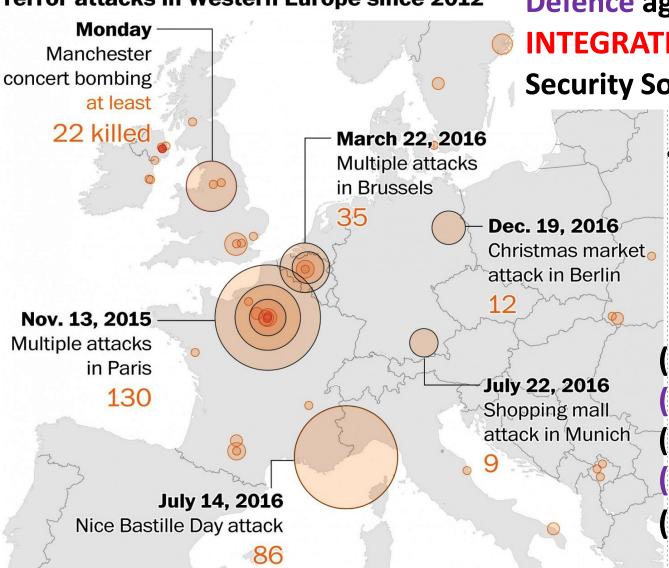■ Русские войска
◨ ◨ Французская и русская кавалерия
▪▪▪▪ ▪▪▪▪ Артилерия

1 КМ   2 КМ

21ˢᵗC Warfare: "Urban Terrorism"

Terror attacks in Western Europe since 2012

Monday
Manchester concert bombing at least
22 killed

March 22, 2016
Multiple attacks in Brussels
35

Dec. 19, 2016
Christmas market attack in Berlin
12

Nov. 13, 2015
Multiple attacks in Paris
130

July 22, 2016
Shopping mall attack in Munich
9

July 14, 2016
Nice Bastille Day attack
86

Source: IHS Jane's Terrorism and Insurgency Center

THE WASHINGTON POST

Defence against *"Urban Terror"* needs **INTEGRATION** of **PHYSICAL** & **CYBER** Security Solutions = **SMART SECURITY**

"Bad Guys" use **Cyber Tools** & Resources to extensively **Research** & **Launch** Major **Physical Terror Attacks!**

(1) **DarkWeb** for **Weapons!**
(2) **Research** Urban Targets
(3) **Social Media** for Comms
(4) **Recruitment** & Training
(5) **Ransomware** for CA**$**H..

Cyber Criminal Team Skillset!...

- Skills required by the **"Bad Guys"** to launch and manage major Cyber Crime Campaigns:
    - **ICT:** Cyber Technical Specialist (Hacking Tools)
    - **Finance:** Money Laundering & Campaign Budget
    - **HR-Human Resources:** Headhunting Cyber Talent!
    - **Intelligence:** Recruit "Insiders" in Business/Govt
    - **Project Management:** Co-ordinate Campaign!
    - **Security:** Detect "BackDoors" both in the Physical and Cyber Defences of the Target Business/Govt
    - ...In summary, the **"Bad Guys"** will often organise themselves as an *Criminal Cell or Illegal Business*!
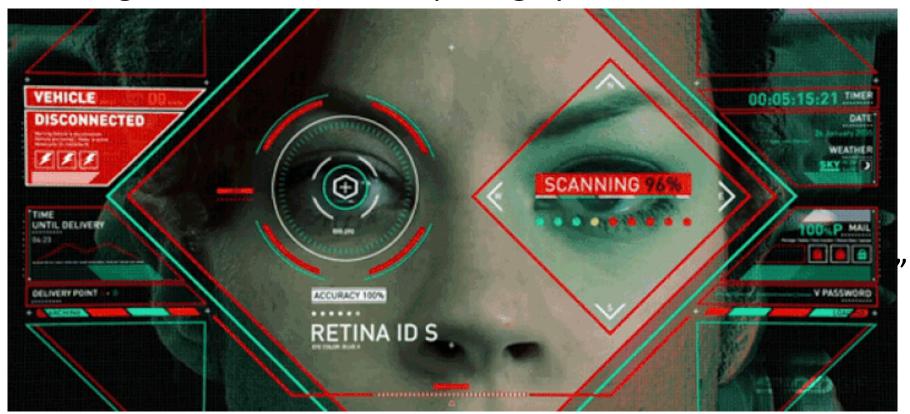
"Cyber" Tracking & Profiling: *"Bad Guys"*

- Mitigating Global Crime & Terrorism requires us to **Profile & Track** the "Bad Guys" in "Real-Time" with Intelligent Networked Computing Systems:

  - 3D Video Analytics from CCTV Facial Profiles
  - Track On-Line Social Media, eMail & "Cell" Comms
  - Scan "DarkWeb" for "Business Deals", Plans & Messages
  - Check, Track & Locate Mobile Communications
  - Track "Bad Guys" in National Transport Hubs
  - Deploy RFID Devices to Track High-Value & Strategic "Assets"
  - Use Real-Time ANPR for Target Vehicle Tracking

  ...*Cyber Computing Smart Apps* can now Track Massive Databases of Target "Bad Guy" Profiles *@ Light Speed!...*

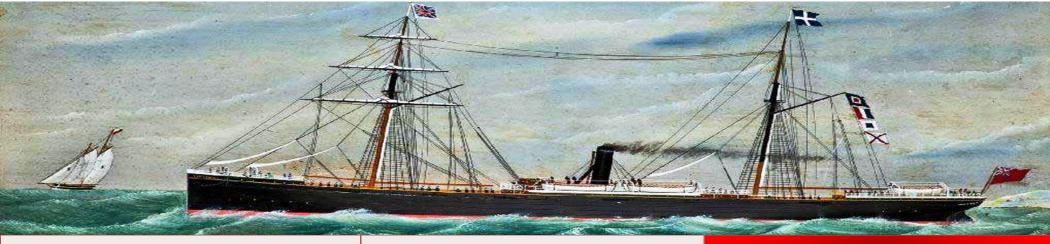# "Cyber" Tracking & Profiling: *"Bad Guys"*

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*Cyber*Security 2018-2025 & *Beyond*!...
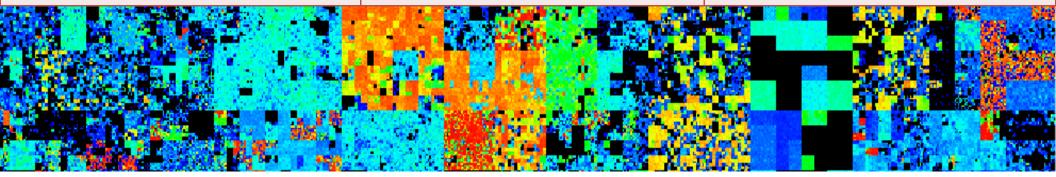
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4 –Scenario 2019: Internet of Things - IoT "Self-Adaptive"	5 –Scenario 2020: Machine Learning "Self-Learning"	6 –Scenario 2025: Artificial Intelligence "Cyber-Intelligent"
7 – Scenario 2040: Artificial Silicon Life! "Neural Security"	8– 21stC **Maritime Security** Trends "Cyber @ Sea"	9 –Cyber **VISION** to Security **NOW**!.. "NEW Cyber Toolkit"

Ship: SS Kinsembo – Liverpool to Congo - 1885
ISSA Summer CyberSecurity Conference 2018
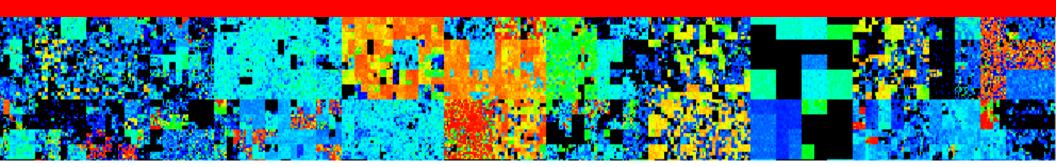
55

CyberSecurity 2018-2025 & *Beyond*!...

3- Scenario 2018: Cyber & Physical Tools
"Integrated Security"

Ship: SS Kinsembo – Liverpool to Congo - 1885
ISSA Summer CyberSecurity Conference 2018

Global Exploration - 1885 – 1887 : *Rev Herbert E. Probert*

- *Travelling from Big Horn, Wyoming, USA to Equatorville, Congo, Central AFRICA -*
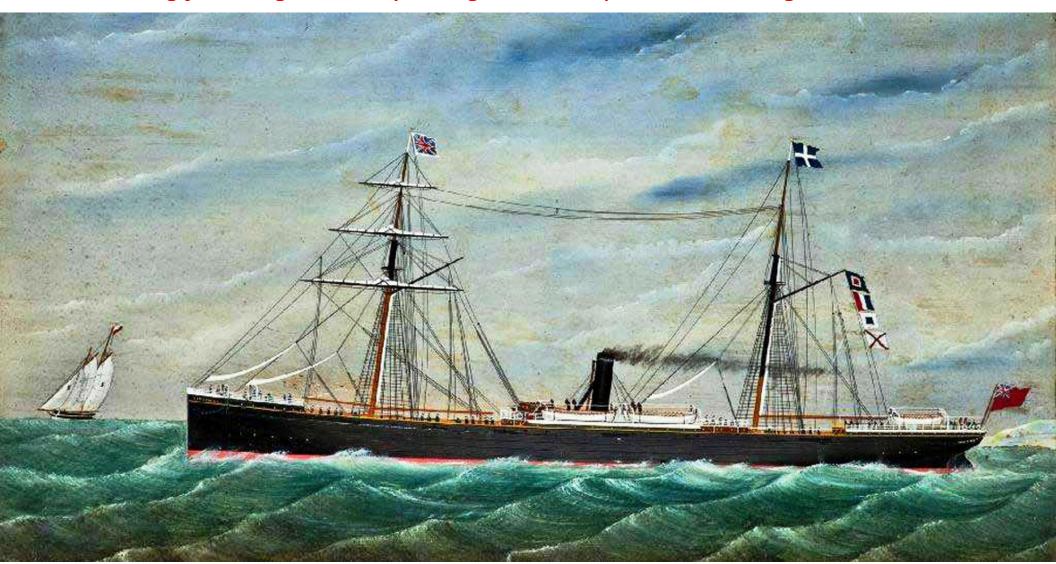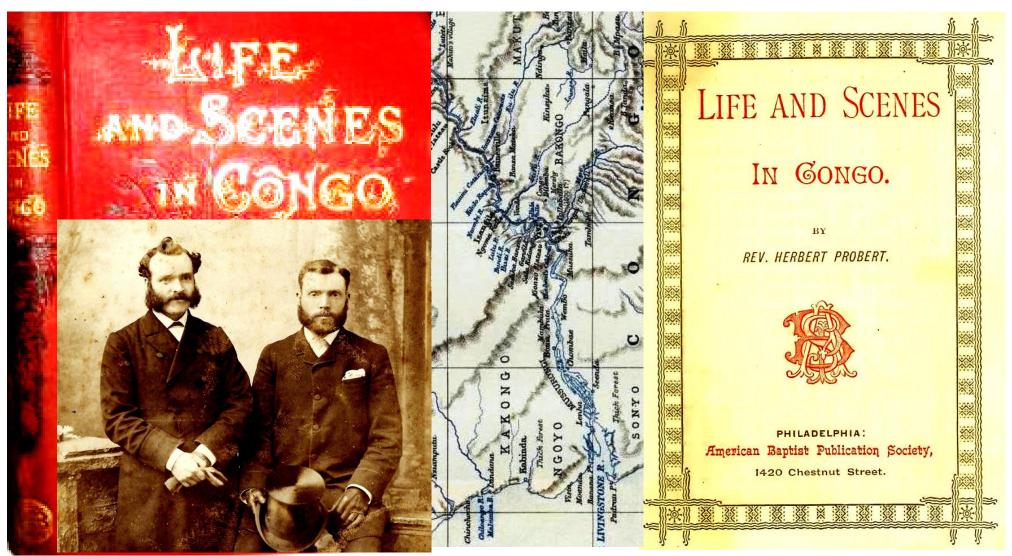
"Life and Scenes in Congo" – Published 1889 – Free *eBook* download from: www.archive.org

Global Exploration - 1885 – 1887 : *Rev Herbert E. Probert*

- Travelling from Big Horn, Wyoming, USA to Equatorville, Congo, Central AFRICA -

"Life and Scenes in Congo" – Published 1889 – Free *eBook* download from: www.archive.org

Our CyberVision: *2018 to 2025+*

- **Scenario 2018 –** *Integrated Security***:** Managed "Smart" *Cyber* & *Physical* Operations under *"CSO"*

- **Scenario 2019 –** *Adaptive Security:* Distributed "Smart Security" for networked *"Internet of Things"*

- **Scenario 2020 –** *Learning Security:* Transition to *"Machine Learning"* Cybersecurity Apps & Tools

- **Scenario 2025 -** *Intelligent Security:* CyberSecurity based upon Networked *"Artificial Intelligence"* Tools

Scenario 2018: "Cyber Tools Transition"
*** Integrated Security***

- Major Trends & Developments: **Scenario 2018**:

  – **C$O led Integration** of Physical and Cyber Security Assets across Corporate Business and Government : CCTV, ANPR, Access Control, Cyber Defence & Alerts

  – **Adaptive AI/ML** Solutions launched by Major Cyber Vendors alongside Cylance, Darktrace & Deep Instinct

  – Increased **National Government Priority** & Investment in fighting Organised CyberCrime and CyberTerrorism

  ..."Cyber" goes "TOP Agenda" in **Scenario 2018**!

"Smart Security" = Cyber + PSIM + SIEM

- **Cyber:** Spans **ALL ICT** Networks, Servers & Devices
- **PSIM:** **P**hysical **S**ecurity **I**ntegration **M**anagement
- **SIEM:** **S**ecurity **I**nformation & **E**vent **M**anagement
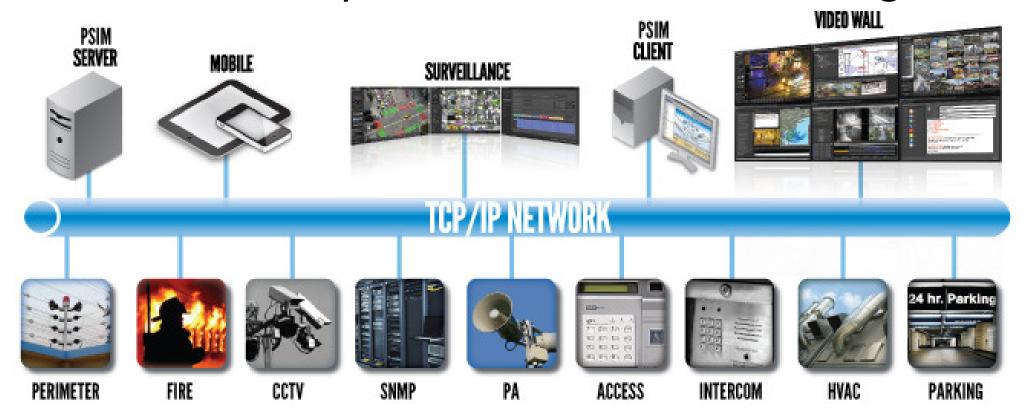
Image: AventuraCCTV.com/PSIM : New York, USA
ISSA Summer CyberSecurity Conference 2018

61

Regional CCTV *Control & Surveillance*
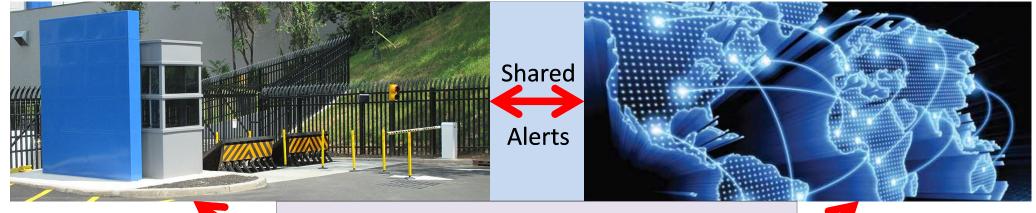
CCTV Control Room Operators with Multiple Displays need Cyber Analysis Tools Including High Speed Video Analytics, Facial Recognition and Data Mining Tools

Integration of *Physical and Cybersecurity*

Integrated CSO-led Management Team – *Merged HQ Operations*

Physical Security Operations

Cyber Security Operations

Shared
Alerts

Smart Security = *Virtual Integration*

Corporate CSO-led Security Team
ONE – Dashboard!

Integrated Management,
Training, Standards, Plans
ONE – Architecture!

Final phase of Cyber-Physical Integration - Embedded Intelligence in ALL Devices - Internet of Things

CSIM Example: "VIDSYS Inc - Enterprise 2018"
ISSA Summer CyberSecurity Conference 2018
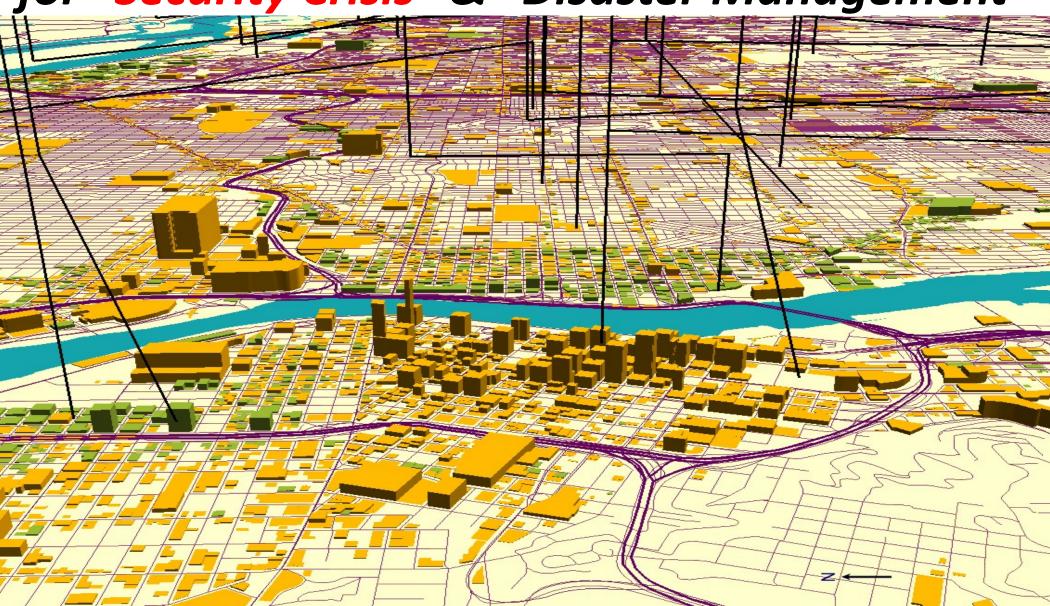
63

Smart Analysis Tools: 3D Simulation Modelling for "Security Crisis" & "Disaster Management"

Integrated *Cyber* Biometrics: *Pre-Attack*
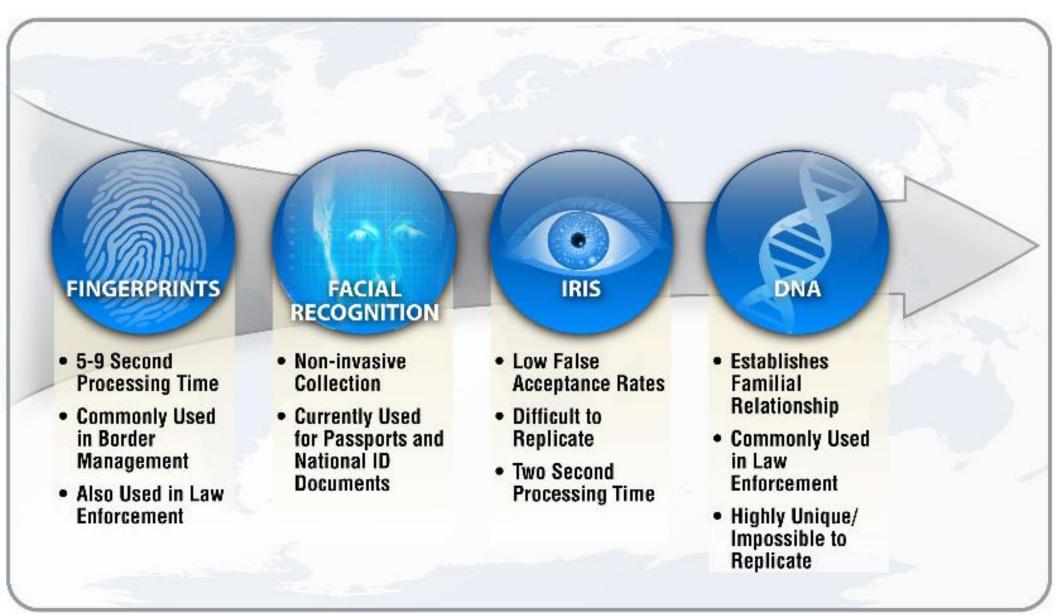
- *Intelligent Biometrics Tools* can significantly reduce **YOUR** Risks of Cyber Threats & Attacks...

    - Device & Access Authentication by Fingerprints, Retinal/Iris Scan or Palm Vein Scan
    - Facility Access with "Live" 3D Facial Recognition
    - "Behavioural Biometrics" for Secure User Authentication
    - City/Campus Regional Tracking with Intelligent 4K Networked CCTV & Real-Time *Self-Learning* Video Analytics
    - "Live" **CBRN** Scanning for Hazardous materials – (**C**hemical, **B**iological, **R**adiological, **N**uclear)

...It is crucial that *Cyber Biometrics Tools* are Integrated with the CSO-led ***Business Security Operations***

Typical Cyber-Biometric Solutions

FINGERPRINTS
- 5-9 Second Processing Time
- Commonly Used in Border Management
- Also Used in Law Enforcement

FACIAL RECOGNITION
- Non-invasive Collection
- Currently Used for Passports and National ID Documents

IRIS
- Low False Acceptance Rates
- Difficult to Replicate
- Two Second Processing Time

DNA
- Establishes Familial Relationship
- Commonly Used in Law Enforcement
- Highly Unique/ Impossible to Replicate
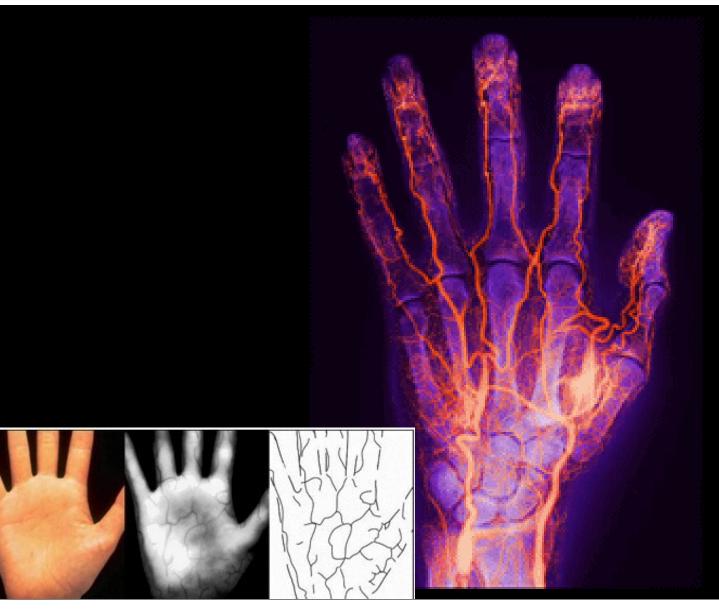
Cyber-Biometrics: *Fingerprint Solutions*


```
37290664790427690437590634790670349276903476
23679247690376903470967349076
347690347690
367904
3690476907390576903 46
364709436
7309479037690
36730947
679034769037
307456906
3376903470937
3760379063
6730976903760397
6730976-0439
673094790760376 03
6730976
730475903769037690730
67390467037
3670394949903767030 76302
```

SEARCHING DATABASE.

Cyber-Biometrics: *"Live" Vein Analytics*

Cyber-Biometrics: *Retinal & Iris Scans*
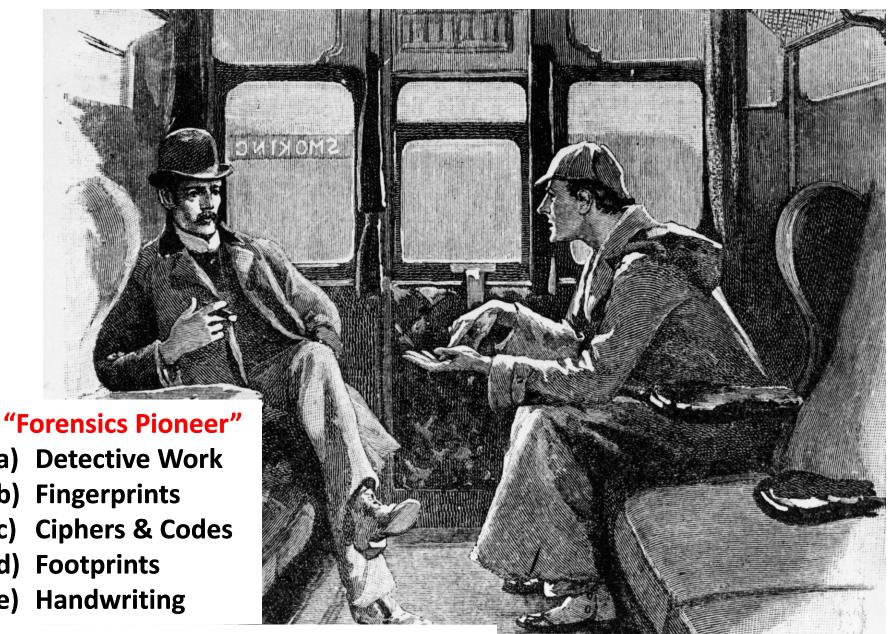
Private Detective: *"Sherlock Holmes"!*

"Forensics Pioneer"
a) Detective Work
b) Fingerprints
c) Ciphers & Codes
d) Footprints
e) Handwriting
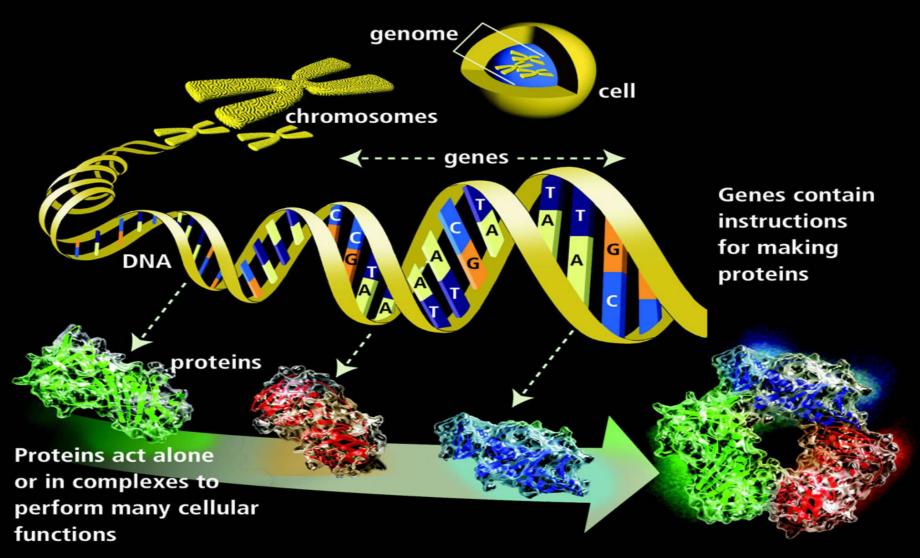
Author: *Sir Arthur Conan Doyle:* 1859 - 1930

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Forensics: *Fast DNA Finger Printing*

genome

cell

chromosomes

genes

DNA

Genes contain instructions for making proteins

proteins

Proteins act alone or in complexes to perform many cellular functions

U.S. DEPARTMENT OF ENERGY

Fast DNA Sequencing: *Graphene Nanopore*

DNA Sequencing Through Graphene Nanopore

Cyber-Bio: Integrated *Security Scenarios*

- **Banks/Finance: e**Fraud, DDOS, Insider Threats
- **Government/Parliament:** "Fake IDs" & File Theft
- **Defence/Military:** Cyber-Espionage & Attacks
- **Travel/Tourism:** Beach Resorts & Travel Hubs
- **Culture/Sports:** Major Events & Competitions
- **Energy/Utilities:** Nuclear Theft, Explosions
- **Retail/Malls/Campus:** Armed Attacks & Siege
- **Healthcare/Pharma:** "Fake Drugs & Records"

...ALL Generic *Cyber-Bio Threats* apply to ALL
Our Business Sectors & Critical Infrastructure!
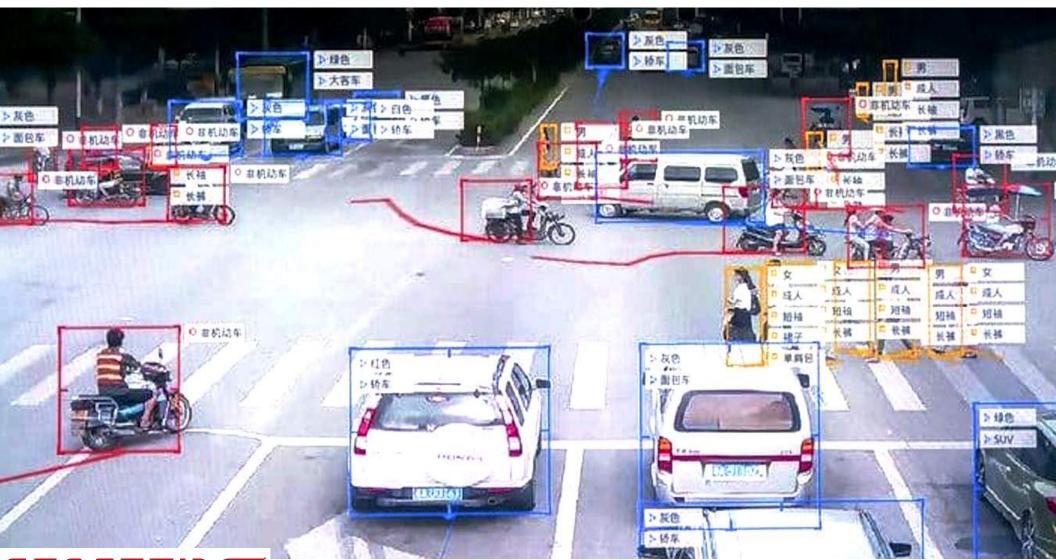
"Real-Time" *City Video Surveillance*

Analysing and Tracking Targets requires *Intelligent Video Analytics*

SENSETIME : *AI Cyber-Bio Surveillance*

SENSETIME :*AI Biometric Video Analytics -"Chinese Unicorn"*

商 汤 科 技 www.sensetime.com

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SENSETIME : *AI Cyber-Bio Surveillance*

SENSETIME 商 汤 科 技 : *AI Biometric Video Analytics -*"**Chinese Unicorn**"

www.sensetime.com

*Cyber*Security 2018-2025 & *Beyond*!...

1-CyberCrime:CyberTerror:CyberWar **"OUR Cyber Society"**	2 – **"TOP 10"** Cyber Attacks & Threats **"YOUR Cyber Defence"**	3 –Scenario 2018: Cyber & Physical Tools **"Integrated Security"**
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Ship: HMT Ascanius – Devonport to Durban - 1917
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77
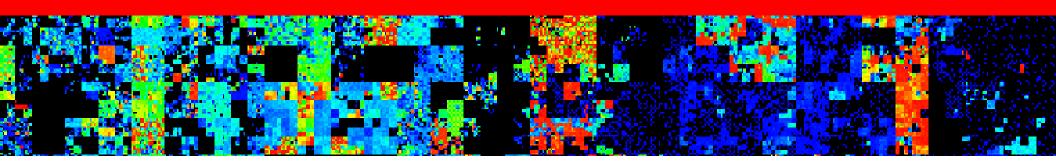
CyberSecurity 2018-2025 & Beyond!...

4 –Scenario 2019: Internet of Things - IoT
"Self-Adaptive Security"

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"21stC CyberSecurity Defence & Trends"
**** From 2018 - 2025 & Beyond! ****
HQS Wellington, London, UK – 5th July 2018
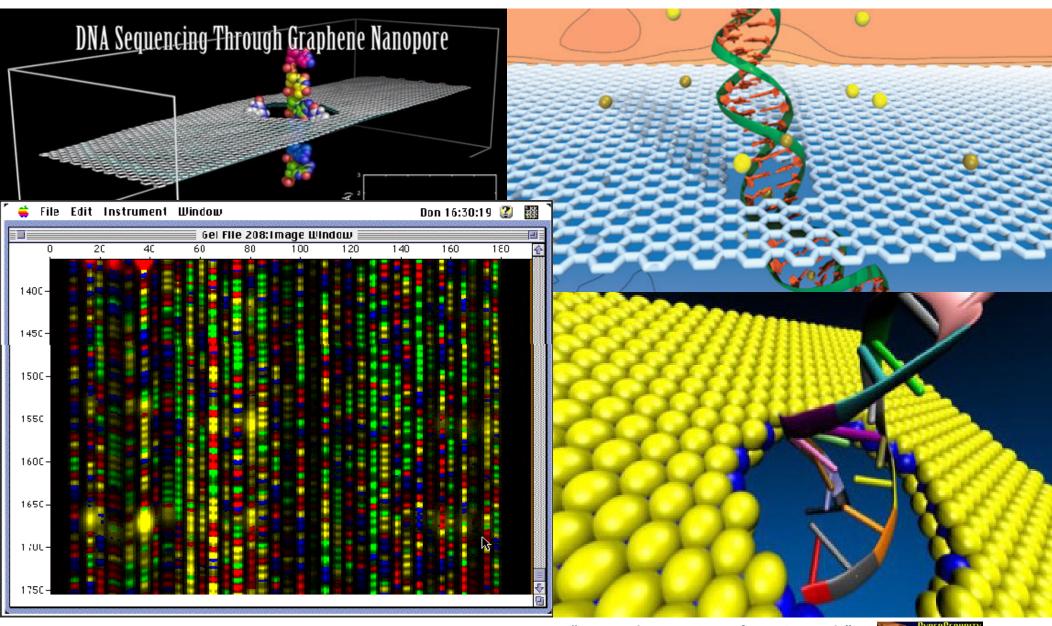© Dr David E. Probert   :   www.VAZA.com ©

78
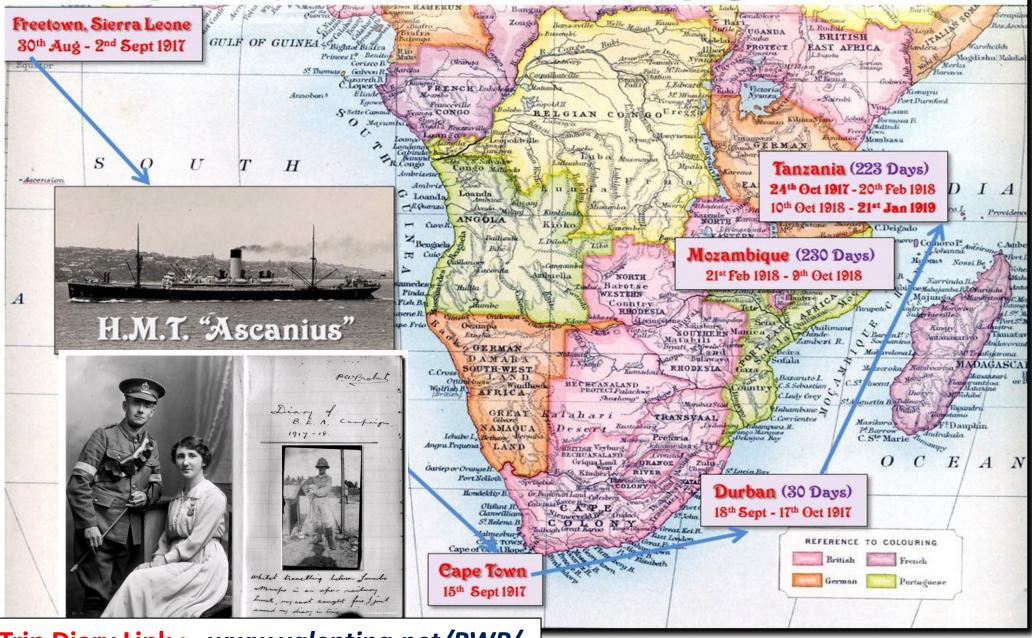
Route Map of **Percy Probert's** East African Campaign Travels: 1917 - 1919

Freetown, Sierra Leone
30th Aug - 2nd Sept 1917

H.M.T. "Ascanius"

Diary of B.E.A. Campaign 1917 -18.

Tanzania (223 Days)
24th Oct 1917 - 20th Feb 1918
10th Oct 1918 - 21st Jan 1919

Mozambique (230 Days)
21st Feb 1918 - 9th Oct 1918

Durban (30 Days)
18th Sept - 17th Oct 1917

Cape Town
15th Sept 1917

REFERENCE TO COLOURING
British   French
German   Portuguese

Trip Diary Link : *www.valentina.net/PWP/*

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Scenario 2019: "Internet of Things - IoT"
*** Adaptive Security***

- Major Trends and Developments: **Scenario 2020**
  - **ALL Major Cyber Vendors** market AI/ML Solutions
  - Updated **ISO/NIST** Standards with Adaptive Security
  - Embedded "Cyber" in ALL New **Smart IoT** Devices
  - Board Level **C$O in C-Suites** with CEO, CFO & COO
  - International Protocols on **Cyber Warfare** (UN/NATO)

.....**CyberSecurity** now focused on **Self-Adaptive** Modelling of "Normal" Net/User Behaviour & Detection of **Real-Time Anomalies & Threats**!

2020 Estimates for "IoT" Connectivity

Figure 3:
Industry estimates for connected devices (billions) in 2020[2]
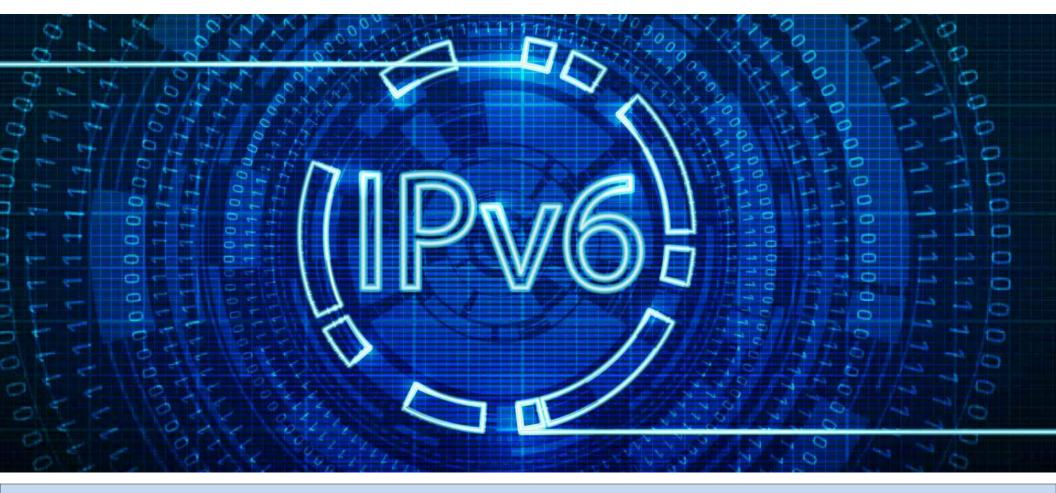
1 'Internet of Things Connections Counter', Cisco Systems, 2014
2 http://www.businessinsider.com/75-billion-devices-will-be-connected-to-the-internet-by-2020-2013-10; https://www.
  abiresearch.com/market-research/product/1016390-over-30-billion-wireless-connected-devices/; 'Forecast: The Internet of
  Things, Worldwide 2013', Gartner, 2013; 'The State of Broadband 2012: Achieving digital inclusion for all', Broadband commission,
  2012; 'The Internet of Things: How the next evolution of the Internet is changing everything', Cisco Systems, 2011; 'Towards
  50 Billion Connected Devices', Ericsson Research, 2010; 'The Internet of Things: Networked objects and smart devices', The
  Hammersmith Group, 2010; http://www.marketplace.org/topics/tech/indie-economics/2020-there-will-be-10-web-connected-
  devices-human; 'The Connected Life: A USD 4.5 trillion global impact in 2020', GSMA and Machina Research, 2012; http://www.
  itpro.co.uk/626209/web-connected-devices-to-reach-22-billion-by-2020
3 'The Internet of Things is Now', Morgan Stanley, 2014

2018 - 2025: Migration from IPv4 to IPv6

$20^{th}C$ – 1st Gen: **IPv4** – 2^{32} = 10^9+ Devices (*IP Address Space almost fully assigned*)

$21^{st}C$ – 2nd Gen: **IPv6** – 2^{128} = 10^{38}+ Devices (*Networking "Internet of Things – IoT"*)

- *Expanded IP Address Space for "IoT" sets new "Cybersecurity Challenges"! -*

RESEARCH PAPER

on

The Compromised Devices

of the Carna Botnet

(used for "Internet Census 2012")

by Parth Shukla,

Information Security Analyst,

Australian Computer Emergency Response Team (AusCERT),
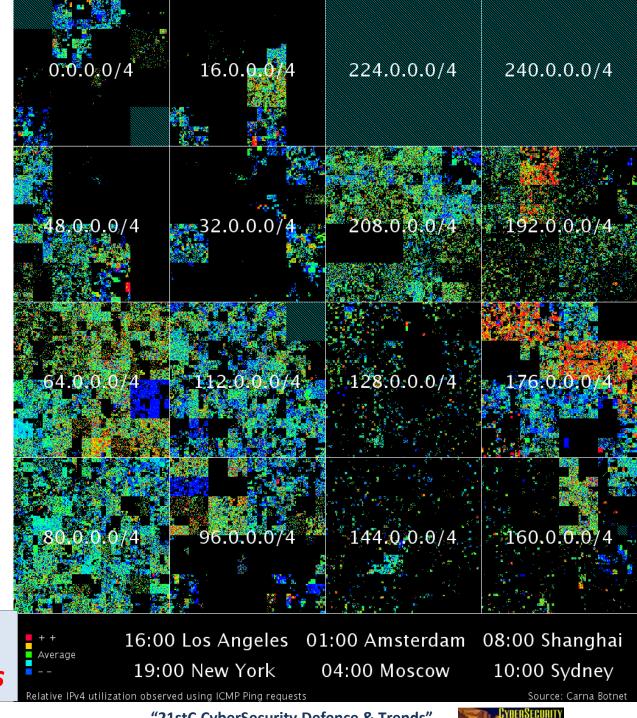
University of Queensland.

Email: pparth@auscert.org.au

Twitter: http://twitter.com/pparth

Version 1

Carna Botnet exposed Legacy Vulnerabilities in *"IoT" Devices*

++	16:00 Los Angeles	01:00 Amsterdam	08:00 Shanghai
Average			
--	19:00 New York	04:00 Moscow	10:00 Sydney

Relative IPv4 utilization observed using ICMP Ping requests

Source: Carna Botnet

EU/IERC – Research Cluster Reports:
"Smart Systems" & the Internet of Things

BlockChains & *CryptoCurrencies*

- **BlockChains:** Distributed "Spreadsheets " with Encrypted Verification of "Financial Contracts"
  - Apps in MOST Economic Sectors for Peer-to-Peer On-Line Trading with NO Central Authority...
  - Apps from Banks, Governments, & Retail Sectors

- **CryptoCurrencies:** Virtual Currencies include BitCoin, Ethereum, LiteCoin, Ripple & Zcash
  - Now more than 1000 Virtual CryptoCurrencies!....
  - BitCoin is still most widely traded Virtual Currency

... BlockChain Apps may improve CyberSecurity for On-Line Trading & Financial Contracts!...

*Cyber*Security 2018-2025 & *Beyond*!...
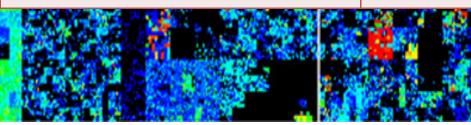
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Whiskey Class Submarine S189 – St Petersburg
ISSA Summer CyberSecurity Conference 2018

86
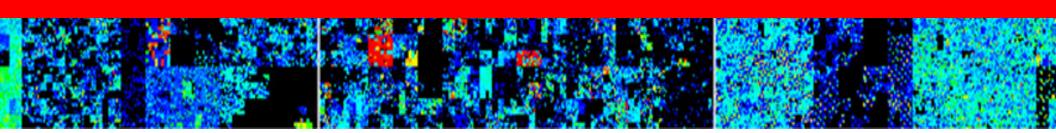
CyberSecurity 2018-2025 & Beyond!...

5 – Scenario 2020: Machine Learning
"Self-Learning Security"

Whiskey Class Submarine S189 – St Petersburg
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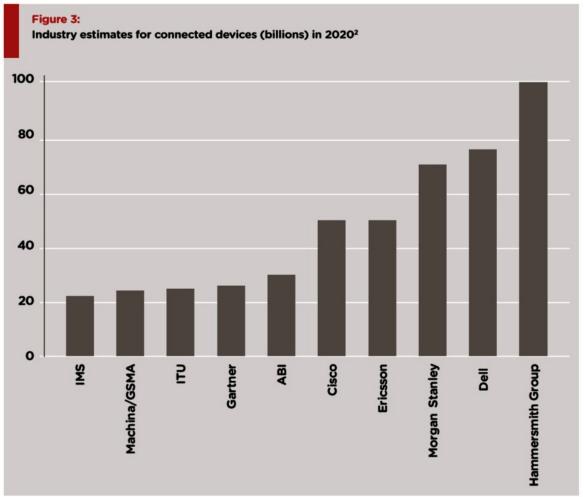© Dr David E. Probert : www.VAZA.com ©

87
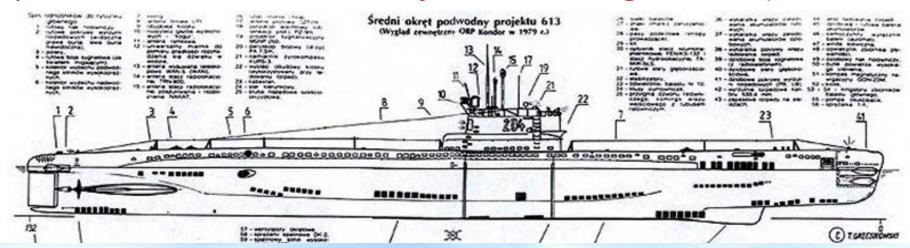
Whiskey Class – Soviet Submarines (Project 613)
*Proposed Barter Deal in 1992 for IT **Training Centre** (**СПИИРАН**)*
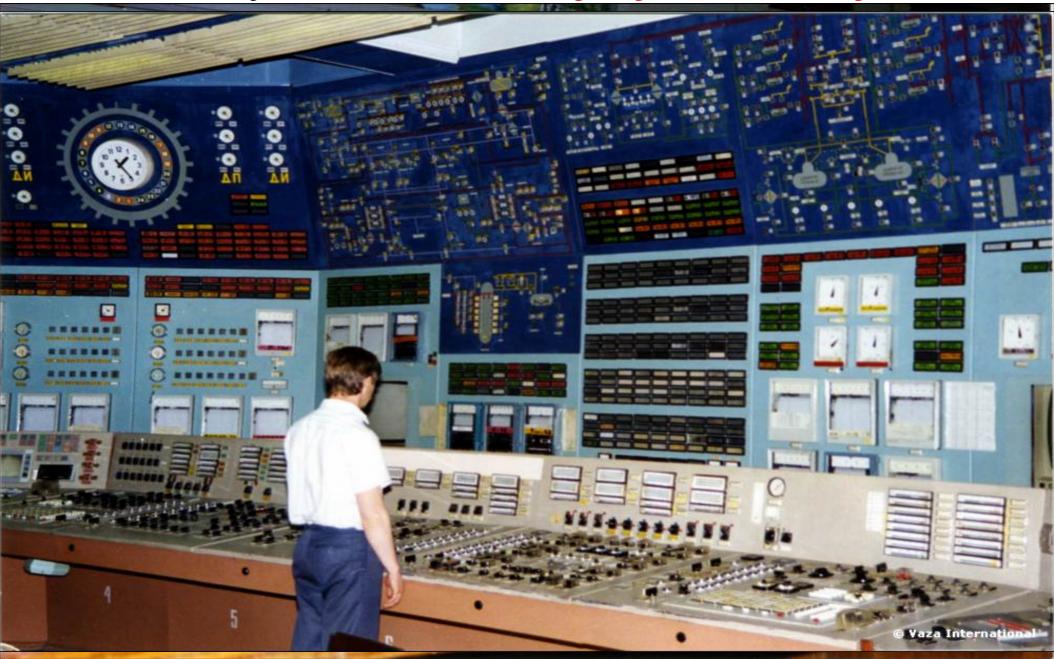
Санкт-Петербургский институт информатики и автоматизации РАН

© Vaza International

© Vaza International

AI & Machine Learning as *Cyber Tools*

- **Artificial Intelligence (AI) :** Developed during 1960s/70s : Neural Networks, Expert Systems, Self-Organising Automata, Adaptive Stochastic Learning, Algorithms, Robotics, Autonomous Systems, Augmented Reality

- **Behavioural Modelling:** AI/ML can be applied to real-time modelling of ALL Network Traffic, Log & Audit Files, Net Nodes, Servers and all "Smart IoT" Devices

- **Zero-Day Attacks:** AI Modelling & Machine Learning can mitigate risks of new malware that have no prior "signature".

- **Advanced Persistent Threats (APTs):** Adaptive Learning Algorithms can detect the step-by-step penetration of APT malware (Phishing, Trojans, Adware, Botnets...)

- **Insider Threats & Attacks:** Enterprise AI Traffic Modelling can quickly expose the malicious activities of malicious "insiders"!
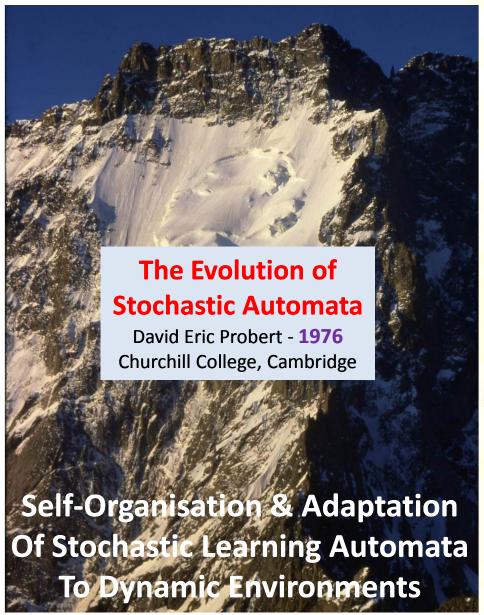
"Cybernetics & Security": 1943 - 2018!
- *Back to the Future: The Last 75 Years! -*

- **1943** – "Neural Networks" – Perceptrons (AI – McCulloch/Pitts)
- **1948** – "Cybernetics" – Norbert Wiener
- **1969** – ARPANet Launched – 4 Packet Switching Net Nodes -
- **1974** – Internet Protocol Published – Vint Cerf/Bob Kahn
- **1982** – Elk Cloner - 1st "Apple Computer Virus
- **1986** – "Brain" – 1st Microsoft MS-DOS Virus
- **1988** – 1st "Packet Filter" Firewall (DEC: Digital Equipment Corp)
- **1990** – World Wide Web – CERN Labs - Sir Tim Berners Lee
- **1993** – Mosaic Browser – NCSA – Illinois, USA
- **2018** –Transition to AI/ML Apps for 21stC CyberSecurity!
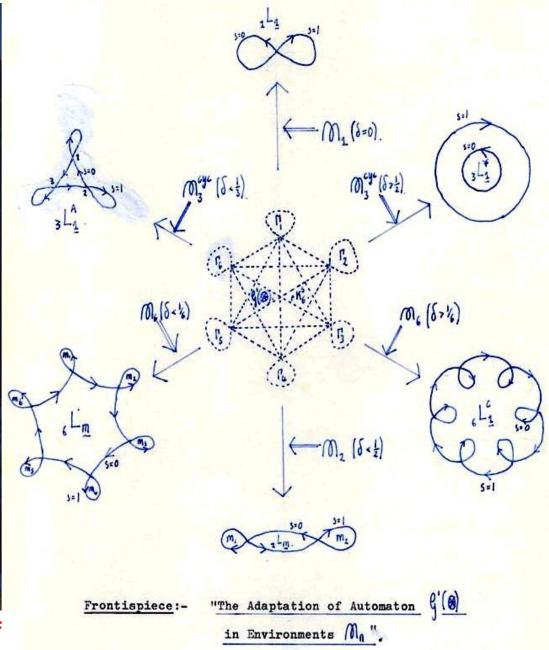
- Exploring "Cyber Visions" requires us to *Research the Past!*

Evolution of Stochastic Automata: *Cambridge, June '76*

The Evolution of Stochastic Automata

David Eric Probert - 1976

Churchill College, Cambridge

Self-Organisation & Adaptation Of Stochastic Learning Automata To Dynamic Environments

Download : **www.valentina.net/Thesis/Thesis.pdf**

Frontispiece:- "The Adaptation of Automaton $g'(\theta)$ in Environments M_n".

- Dept of Mathematics & Statistics -
Cambridge University : 1973 - 1976

David Probert

Scenario 2020: "Advanced Cyber Tools"
*** Self-Learning Security ***

- Major Trends and Developments: **Scenario 2025**
  - Enterprises now deploy **AI/ML** Based **CyberSecurity Tools**
  - **"Augmented Reality"** Cyber Software & **Smart Devices**
  - **C$Os** provide Pan-Enterprise **Physical/Cyber Security**
  - **ICT Networks** migrate to **Self-Learning Neural Security**
  - Intelligent **"AI Bots"** act a *Real-Time* **"Cyber Police"** to Search & Quarantine Resources linked with suspected **CyberCriminals, Political Hacktivists** & **CyberTerror Cells**!

  ....Business & Government **Cyber** Networks & Assets now Secured **24/7** through **"Intelligent AI/ML Bots"**

Worldwide Real-Time Financial Trading
@*Light Speed* – 24/7 – Global Networks

Darktrace: AI/ML CyberSecurity
- The Enterprise Immune System -

www.darktrace.com

THE ENTERPRISE IMMUNE SYSTEM

POWERED BY MATH & MACHINE LEARNING PROVEN TO WORK

DARKTRACE
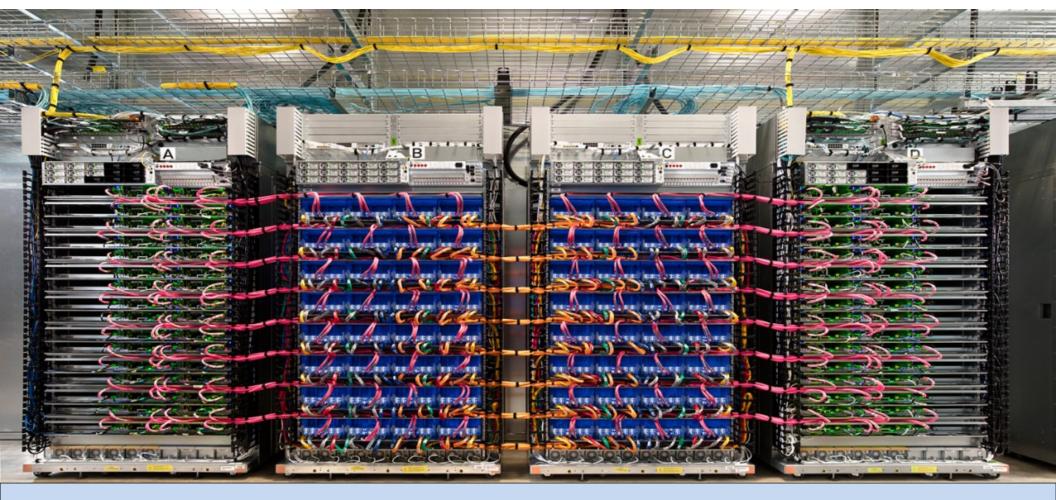
DarkTrace: CyberSecurity Solution that **"Learns"** ALL Net Traffic, Assets & User Behaviour... **...Real-time Alerts** provided & **Assets Quarantined** whenever **"Non-Normal"** Events Detected!

Smart 3D Network Cyber Simulation: *Hyperglance*

www.hyperglance.com

Google I/O: AI/ML Futures – 17th May 2017

Ultra High Speed – Tensor Processing Unit: TPU
*** AL/ML/Big Data Apps - 180 TeraFlops ***

Google I/O: AI/ML Futures – 17th May 2017

"Integrated Intelligent CyberSecurity"
using Google TPU within 5 Years running
Ultra-Fast Real-Time AI/ML/Big Data!

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Google I/O: AI/ML Futures – 17th May 2017

Google Machine Learning Research Centre: Zurich - 2016

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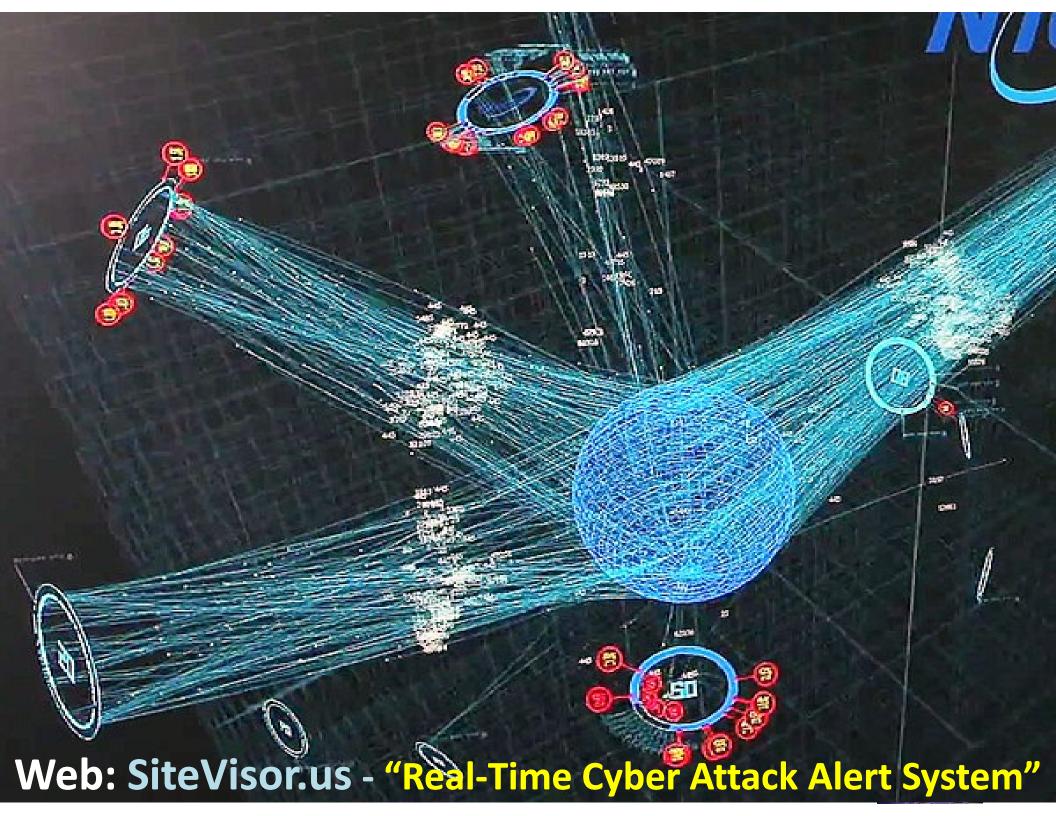
CyberSecurity: Big Data Visualization
Japan – NICT: "Daedalus" - *Cyber Alert*

NICT = **N**ational **I**nstitute of Information and **C**ommunications **T**echnology

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*Cyber*Security 2018-2025 & *Beyond*!...

1-CyberCrime:CyberTerror:CyberWar **"OUR Cyber Society"**	2 – "TOP 10" Cyber Attacks & Threats **"YOUR Cyber Defence"**	3 –Scenario 2018: Cyber & Physical Tools **"Integrated Security"**
4 – Scenario 2019: Internet of Things: IoT **"Self-Adaptive"**	5 –Scenario 2020: Machine Learning **"Self-Learning"**	6 –Scenario 2025: Artificial Intellgence **"Cyber-Intelligent"**
7 – Scenario 2040: Artificial Silicon Life" **"Neural Security"**	8– 21stC Maritime Security Trends **"Cyber @ Sea"**	9 –Cyber VISION to Security NOW!.. **"NEW Cyber Toolkit"**

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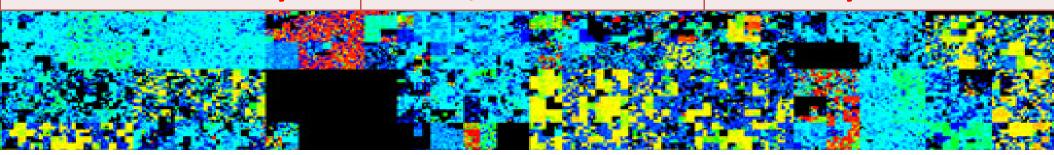
CyberSecurity 2018-2025 & Beyond!...

6 –Scenario 2025: Artificial Intelligence
"Cyber-Intelligent Security"

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105

Scenario 2025: "Intelligent Defence Bots"

1982 < -Review Past 34 years-> **2016** <- Explore Future 34 years-> **2050**

TRON (1982): Sci-Fi Security Perspective!

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106

Scenario 2025: "Intelligent Defence Bots"

1982 < -Review Past 34 years-> **2016** <- Explore Future 34 years-> **2050**

TRON (1982): Sci-Fi Security Perspective!

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Scenario 2025: *"Intelligent Security"*

- Transition & Full Deployment of Enterprise-Wide AI/ML-based **Intelligent** "CyberSecurity" Tools

- Real-Time **Behavioural Modelling** of ALL aspects of Net Traffic, System/Event Logs, Net Nodes, Servers, Databases, Devices & Users

- Focus on **AI/ML Modelling** of the **"Known Good"** to augment Classic Detection using **"Known Bad",** and hence provide New Generation **"Defence In-Depth"**

- Trial Deployment of **Autonomous Real-Time** "Cyber" Alerts that integrate both Traditional & Advanced AI/ML "Cybersecurity Tools"

108
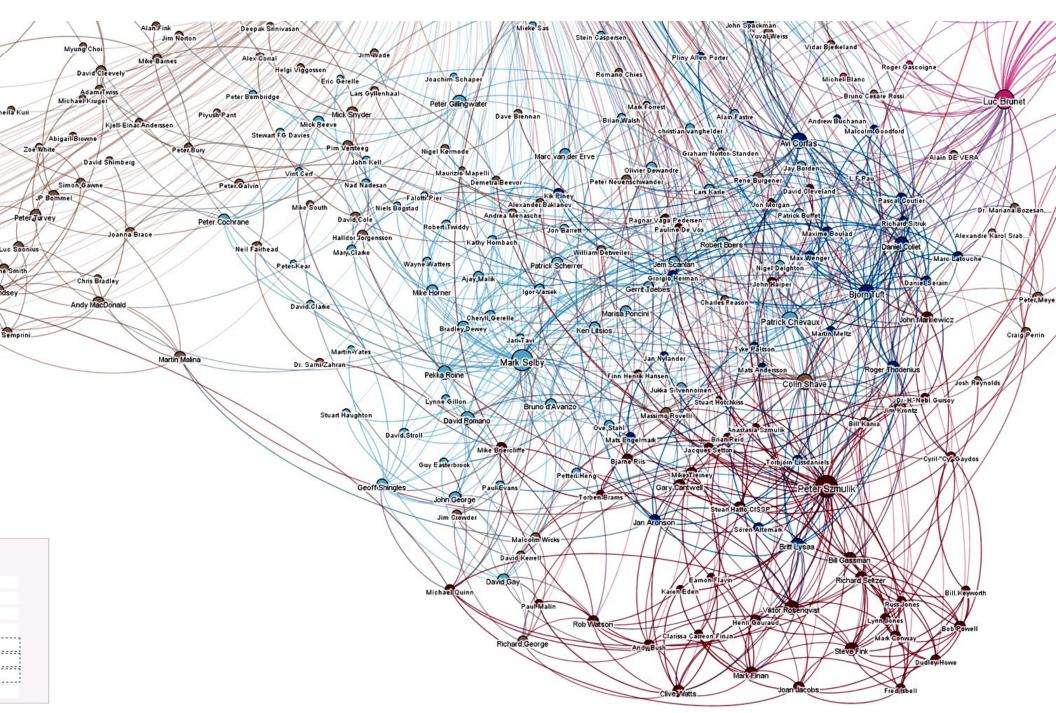
Hybrid 21stC Business Organisation
- Hierarchical & Networked -
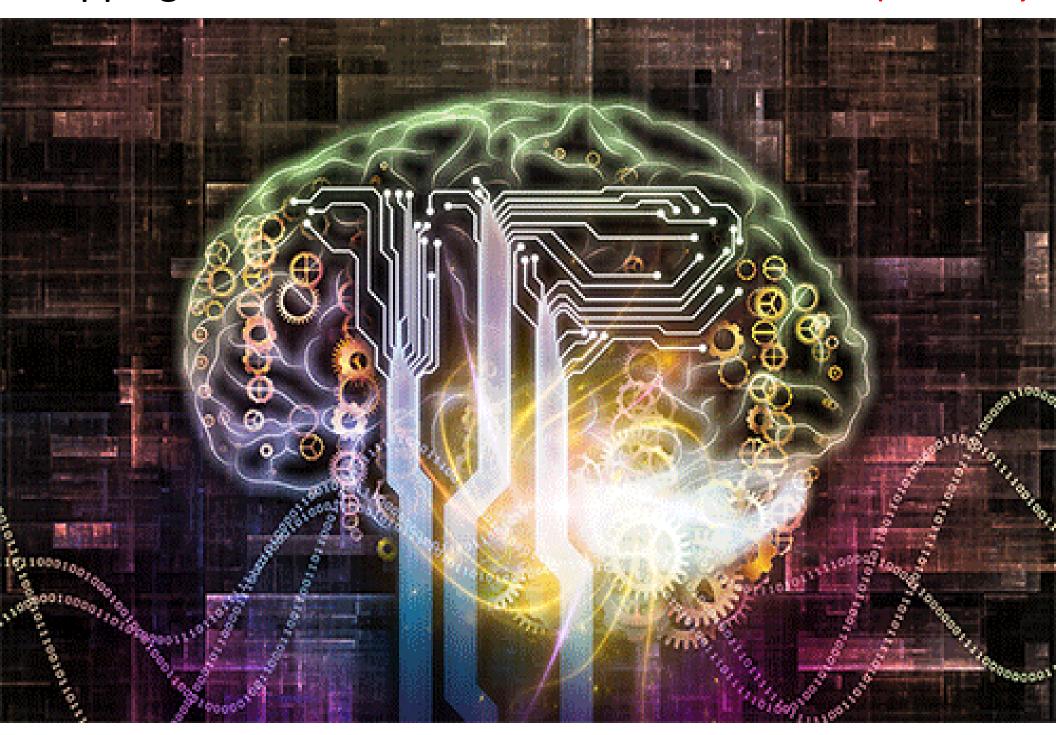
- *Transition* from 20thC to 21stC Business, Governance & Security requires fundamental re-structuring of operations:

  – *20thC Industrial Organisations:* *Hierarchical* Bureaucracies   - *"Pyramids"* - to manually process data/information.

  – *21stC Intelligent Organisations:* *Networked* Peer-to-Peer Business & Agencies with data processed in Global *"BIG Cyber Clouds"*

- *Living Systems*, such as Mammals & Birds, use *Hybrid* Organisation of their extended nervous system (**Brain & Body**) to optimise real-time learning and effective self-organising environmental adaptation!

- *Intelligent Security Solutions* will also require *Hybrid* organisation to optimise real-time response to **Cyber & Physical** Attacks.

Scenario 2025 Business will evolve to Intelligent *Hybrid* Security Operations!

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CyberSecurity
www.vaza.com

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109
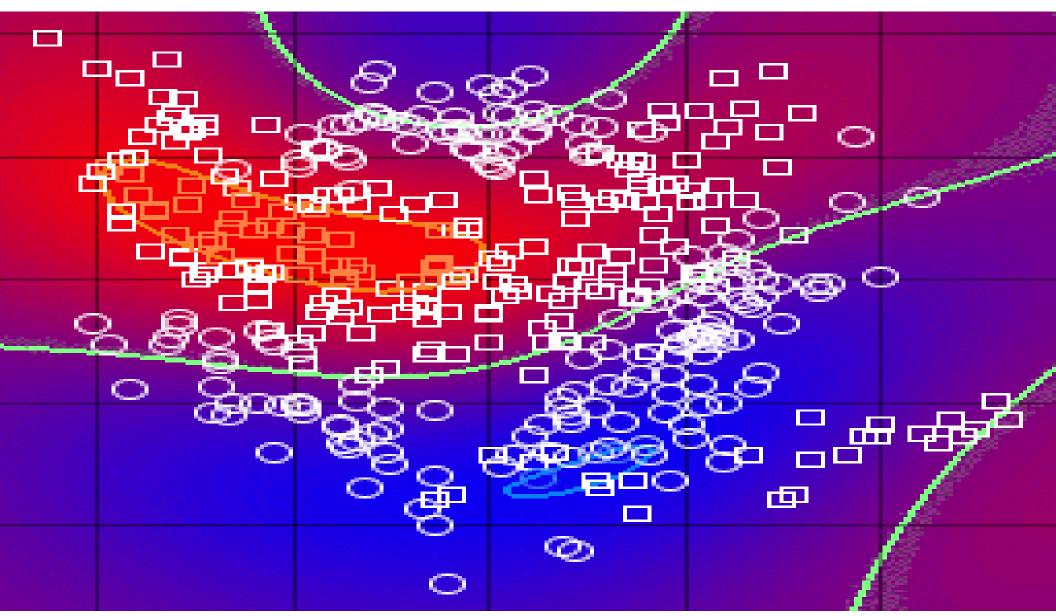
Mapping 21stC Social Media Networks: *LinkedIn (Probert)*

Mapping 21stC Social Media Networks: *LinkedIn (Probert)*

Typical "Machine Learning" Algorithm

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112

Deep Learning & Neural Networks
Advanced CyberSecurity Solutions

ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.

MACHINE LEARNING
Machine learning begins to flourish.

DEEP LEARNING
Deep learning breakthroughs drive AI boom.

NVIDIA – Machine Learning GPUs & Deep Learning Institute

1950's   1960's   1970's   1980's   1990's   2000's   2010's

www.nvidia.com

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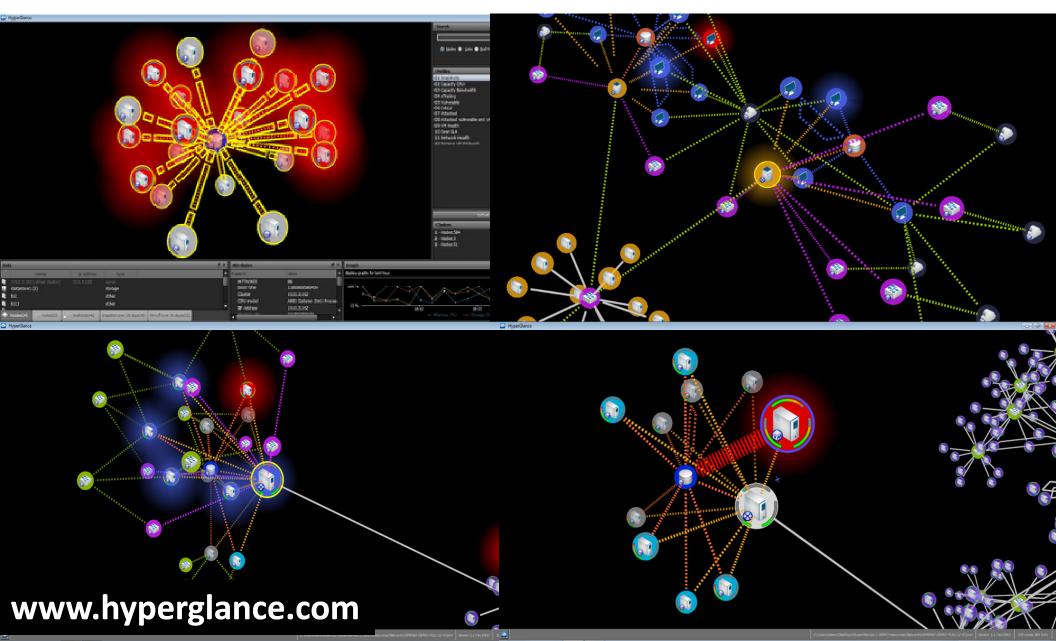© Dr David E. Probert : www.VAZA.com ©

113

Deep Learning & Neural Networks
Advanced CyberSecurity Solutions

HOW A DEEP NEURAL NETWORK SEES

Image

"Audi A7"
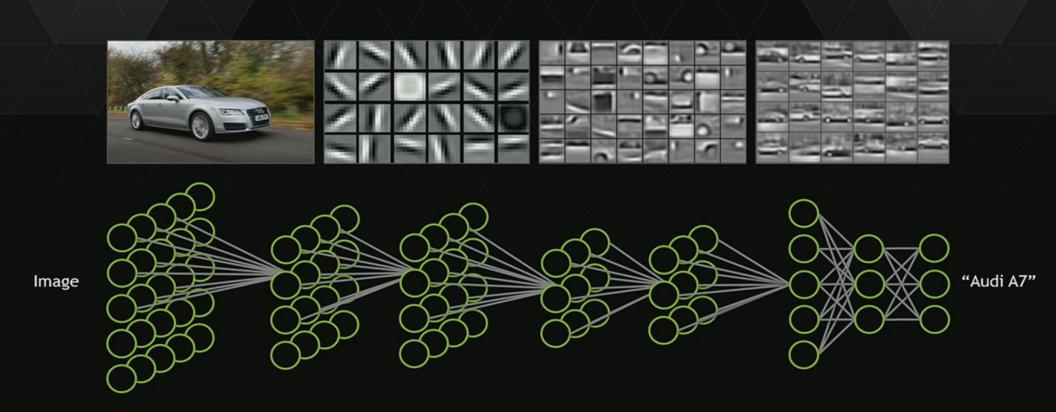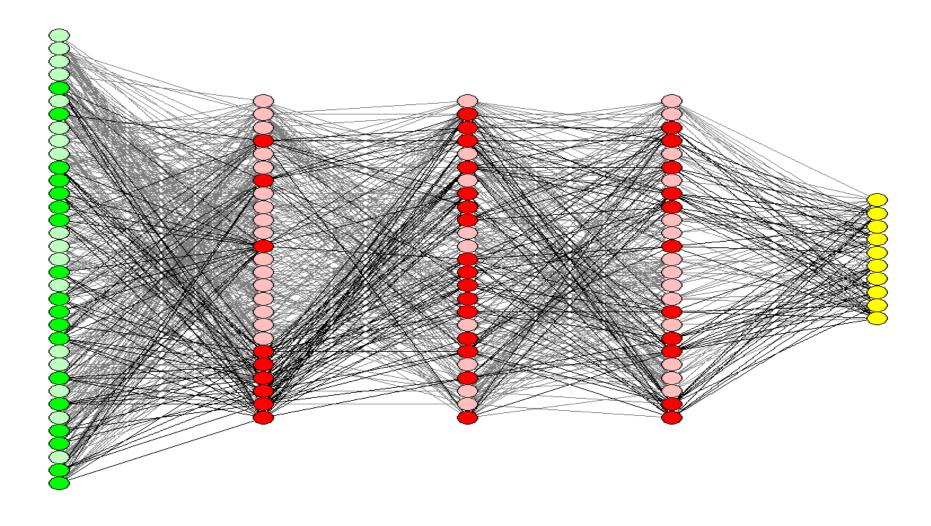
Image source: "Unsupervised Learning of Hierarchical Representations with Convolutional Deep Belief Networks" ICML 2009 & Comm. ACM 2011.
Honglak Lee, Roger Grosse, Rajesh Ranganath, and Andrew Ng.

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114

Deep Learning & Neural Networks
Advanced CyberSecurity Solutions

115

Deep Learning & Neural Networks
Advanced CyberSecurity Solutions

How Artificial Intelligence Will
Secure the 21st Century

Machine Learning and Mathematics Introduce a Brave New World
of Predictive Cybersecurity That Rewrites the Rules of Protection

www.cylance.com/content/dam/cylance/pdfs/white_papers/**AI_and_Machine_Learning.pdf**

CYLANCE™

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DeepInstinct: Real-Time APT Protection

Provides **Deep Learning CyberSecurity** for **APT Protection** of **Mobile** & **End-Points**!

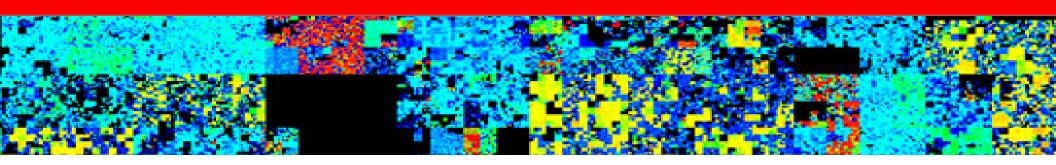-*** **APT** = Advanced Persistent Threat ***
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DeepInstinct: Real-Time APT Protection

Our Value: Zero-Day and APT Prevention

Real-time APT detection and prevention — Deep Instinct enables real-time detection AND prevention capabilities of first-seen malicious activities on all organizational assets.

Prediction of future cyber threats — Deep Instinct's accurate prediction capability is enabled by its proprietary Deep Learning algorithms.

Infrastructure agnostic
- **Mobile:** Immediate on-device decision
- **Endpoints:** Pre-execution action. Faster than real-time!

Connectionless — Light prediction model enables direct action on the device without any external dependency.

Fast and easy deployment — Light agents enabling a smooth deployment with no impact on the entire organization's assets.

www.deepinstinct.com

deepinstinct

Provides **Deep Learning CyberSecurity** for **APT Protection** of **Mobile** & **End-Points**!

-*** **APT** = Advanced Persistent Threat ***
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Senseon: Enterprise AI-Enabled "Cyber Intelligence & Analysis"...

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SingularityNet: Platform for AI Economy
- *Distributed BlockChain Payment Net -*

Launch: *Oct 2017* - **Web**: singularityNet.io - **Founder**: *Dr Ben Goertzel*

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SingularityNet: Platform for AI Economy
- *Distributed BlockChain Payment Net -*

Towards the Singularity

Emergent artificial general intelligence in the AI economy

The proliferation of AI will be one of the biggest growth opportunities this century, with the market forecasted to grow from $234 billion in 2017 to $3.1 trillion by 2025.

As the first platform enabling AIs to coordinate resources and capabilities at scale, SingularityNET is positioned as a critical mediator across all future AI developments.

SingularityNET offers organizations massive financial and operational advantages. The network creates the first interoperability standards for AIs, radically improving the process of discovering and coordinating AI services, while allowing developers to easily monetize AI tech. All of this is made possible through a streamlined, scaleable system for payments through the AGI token.

SingularityNET — Features / Team / Blog / Join

Launch: *Oct 2017* - **Web**: singularityNet.io - **Founder**: *Dr Ben Goertzel*

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*Cyber*Security 2018-2025 & *Beyond*!...

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122

7 – Scenario 2040: Artificial Silicon Life!

"Neural Security"

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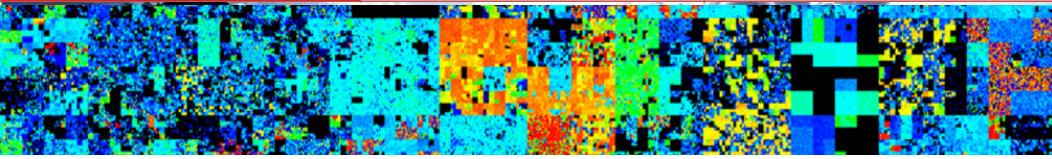
Artificial Intelligence: "HAL 9000"
- 2001 - *A Space Odyssey* (1968) -

A Space Odyssey - 1968 – 2018 – 2068 - Artificial Silicon Life?

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Artificial Intelligence: "HAL 9000"

A Space Odyssey - 1968 – 2018 – 2068 - Artificial Silicon Life?

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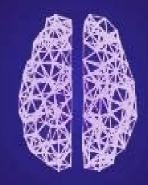© Dr David E. Probert : www.VAZA.com ©

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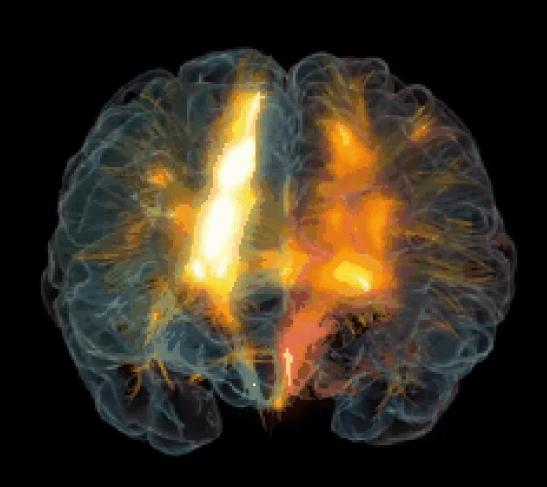
Scenario 2040: *"Neural Security"*

- Full Implementation of Intelligent & Adaptive Cybersecurity across the *Extended Enterprise*

- *Autonomous "Alerts"* and Real-Time AI/ML-based Cyber Event, Traffic & User Modelling

- New Scaled Architectures and Operational Standards for *"Smart Systems"* – Smart Devices, Business, Cities, Government, Economy & Society

- *Quantum Cryptography* for "Unbreakable Codes"!

- Cybersecurity Operations transition to become Ultra-Intelligent – *"Neural Security"* – through Embedded "AI-Security Bots" for Real-Time Defence

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Scenario **2040**: *"Neural Security"*

EEG powered by BCILAB | SIFT

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Scenario 2040: Cyber Defense – NATO & Canada

The Future Security Environment 2013-2040

National Défense
Defence nationale

Canada

Artificial Intelligence in Cyber Defense

Enn Tyugu
R&D Branch
Cooperative Cyber Defense Center of Excellence (CCD COE)
and Estonian Academy of Sciences
Tallinn, Estonia
tyugu@ieee.org

Abstract- The speed of processes and the amount of data to be used in defending the cyber space cannot be handled by humans without considerable automation. However, it is difficult to develop software with conventional fixed algorithms (hard-wired logic on decision making level) for effectively defending against the dynamically evolving attacks in networks. This situation can be handled by applying methods of artificial intelligence that provide flexibility and learning capability to software. This paper presents a brief survey of artificial intelligence applications in cyber defense (CD), and analyzes the prospects of enhancing the cyber defense capabilities by means of increasing the intelligence of the defense systems. After surveying the papers available about artificial intelligence applications in CD, we can conclude that useful applications already exist. They belong, first of all, to applications of artificial neural nets in perimeter defense and some other CD areas. From the other side – it has become obvious that many CD problems can be solved successfully only when methods of artificial intelligence are being used. For example, wide knowledge usage is necessary in decision making, and intelligent decision support is one of yet unsolved problems in CD.

Keywords: applied artificial intelligence; intelligent cyber defense methods; neural nets in cyber defense; expert systems in cyber defense.

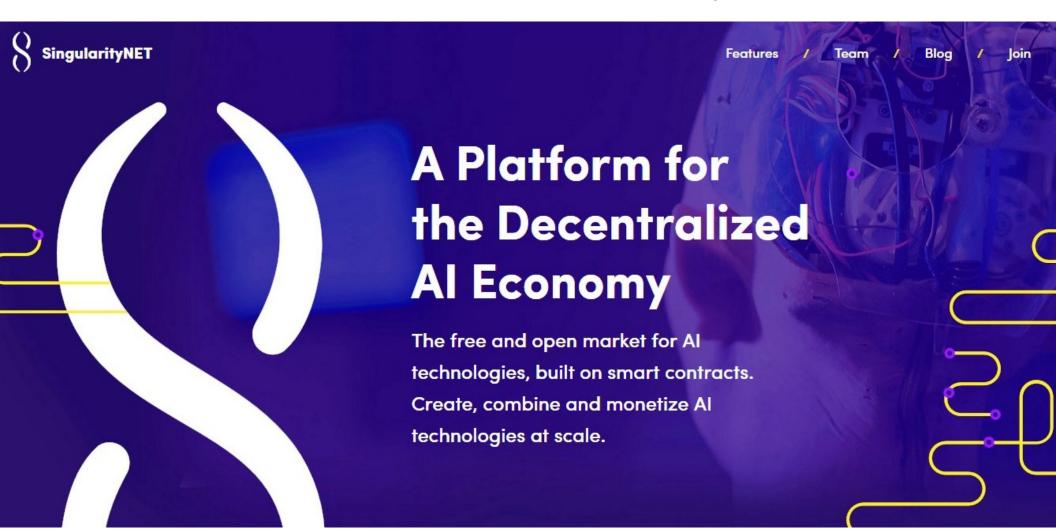**ISSA Summer CyberSecurity Conference 2018**

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Security Futures: *Towards "Neural Society"*

- **Real-Time Security Operations:**
  - Secure and monitor every cyber asset and critical physical asset through IP Networking, RFID Tagging & communication of status to operations centre

- **Augmented & Immersive Reality:**
  - Multimedia virtual world overlays on data from the real physical world, through head-up displays & other forms of embedded sensors & displays

- **Bio Neural Metaphors:**
  - Further developments of self-organising and autonomous systems for monitoring and responding to cyber alerts & attacks in real-time

- **3D Adaptive Simulation & Modelling:**
  - Adaptive 3D computer modelling of physical buildings, campuses & cities, as well as dynamic models of extended enterprises networks. The aim is to visualise, model & respond to security alerts with greater speed & precision

- **"Smart Security" Architectures:**
  - Effective integrated security requires management through hybrid hierarchical and "peer-to-peer" organisational architectures. Living organic systems also exploit hybrid architectures for optimal command & control
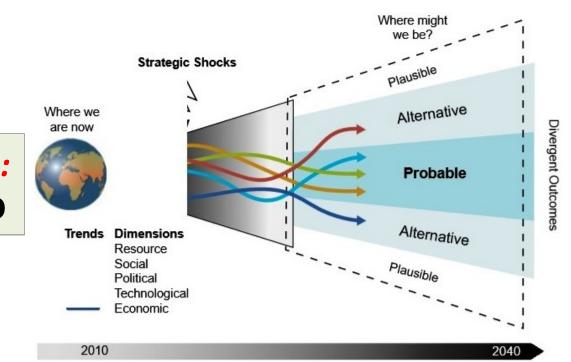
Scenario **2040**: *Cyber Defence:*
UK Ministry of Defence - MOD
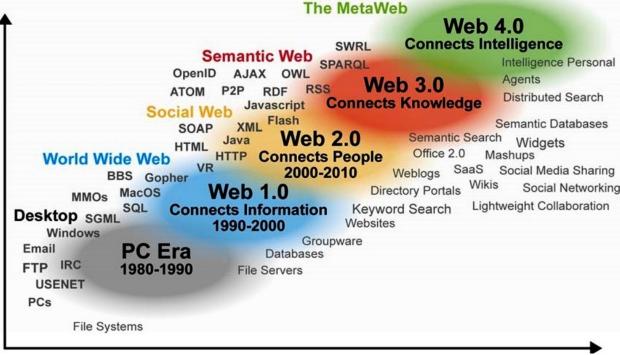
Ministry of Defence

Strategic Trends Programme
Global Strategic Trends - Out to 2040

Fourth Edition

Where might we be?

Strategic Shocks

Where we are now

Plausible

Alternative

Probable

Alternative

Plausible

Divergent Outcomes

Trends Dimensions
Resource
Social
Political
Technological
— Economic

2010   2040

The MetaWeb
Web 4.0
Connects Intelligence

Semantic Web
SWRL
SPARQL
OpenID   AJAX   OWL
ATOM   P2P   RDF   RSS
Javascript
Social Web
SOAP   XML   Flash
HTML   Java
Web 2.0
Connects People
2000-2010
World Wide Web
HTTP
VR
BBS   Gopher
MMOs   MacOS
Web 1.0
Connects Information
1990-2000
Desktop   SGML   SQL
Windows
Email
FTP   IRC
USENET
PCs
File Systems

Web 3.0
Connects Knowledge

Intelligence Personal
Agents
Distributed Search
Semantic Databases
Semantic Search   Widgets
Office 2.0   Mashups
Weblogs   SaaS   Social Media Sharing
Directory Portals   Wikis   Social Networking
Keyword Search   Lightweight Collaboration
Websites
Groupware
Databases
File Servers

Semantics of Informaton Connections

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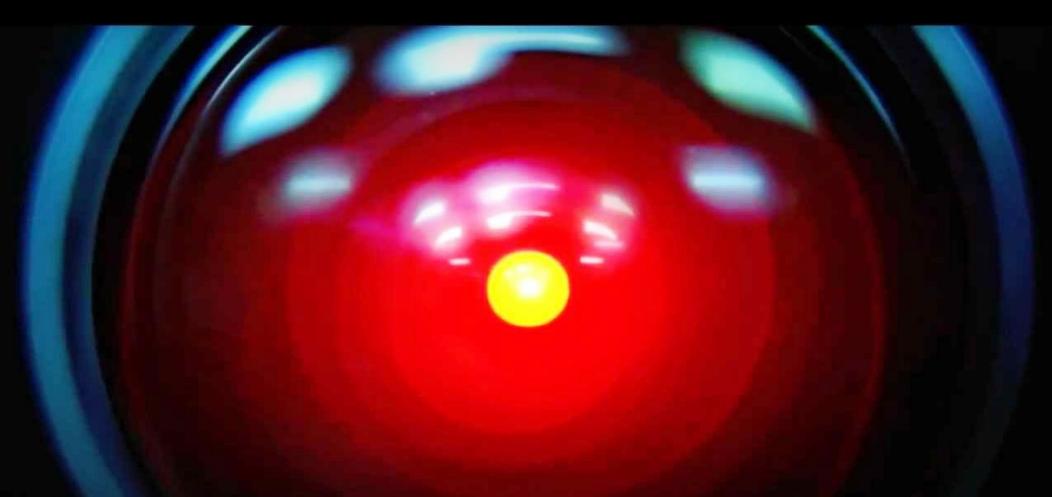HQS Wellington, London, UK – 5th July 2018
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130

Interfacing "Human" and "CyberWorlds"

- **Neural AI/ML CyberSecurity** Solutions will require enhanced Intelligent Human/Machine Interfaces!

- Human Communications run **@ Sound Speed....** whilst Cyber Worlds run *1 Million* **X** faster **@ Speed of Light!..**

- **Virtual, Mixed & Augmented Reality(AR)** Devices & Software(SW) will "Bridge" Human & Cyber Worlds!

....Expect **New Generation AR Devices** & SW Interfaces for Security Management during the next **7 Years!....**

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Scenarios: 2019-2049: *Blade Runner*

Sci-Fi Security for "Artificial Silicon Life"?!

Neural Security for 21st Century Cyber-Physical Society!

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Scenarios: 2019-2049: *Blade Runner*
Sci-Fi Security *for* *"Artificial Silicon Life"*?!

Neural Security for 21st Century Cyber-Physical Society!

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House of Lords:"AI in the UK" – April 2018

HOUSE OF LORDS

Select Committee on Artificial Intelligence

Report of Session 2017–19
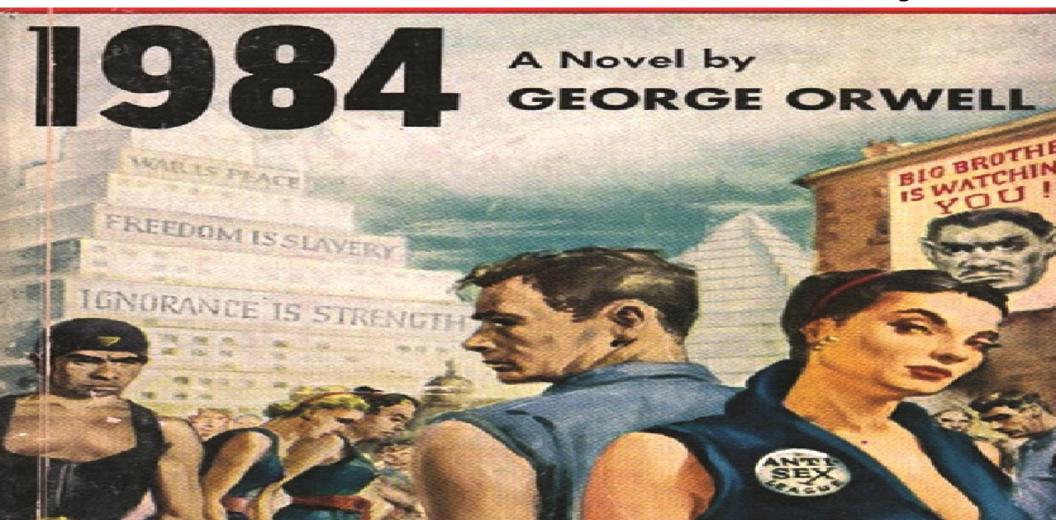
AI in the UK: ready, willing and able?

Link: publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf

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134

1984: *"Birth"* of Intelligent Networks .... & *"Death"* of Personal Privacy ?....

CyberVision: 1984:*Past* – 2018:*Present* – 2050:*Future?*

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7 – **Scenario 2040**: Artificial Silicon Life! **"Neural Security"**	8– **21stC Maritime Security** Trends **"Cyber @ Sea"**	9 –Cyber **VISION** to Security **NOW**!.. **"NEW Cyber Toolkit"**

Ship: SS Nevasa – "School Cruise – April 1967"
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CyberSecurity 2018-2025 & Beyond!...
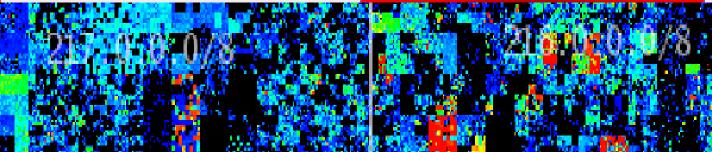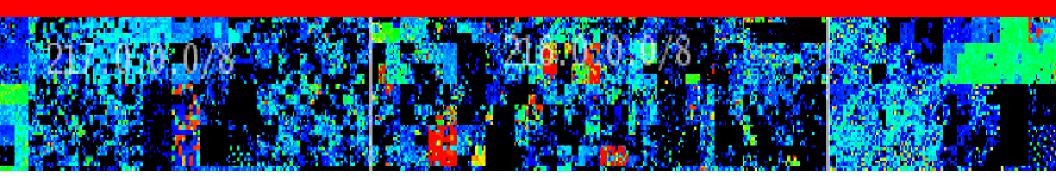
8 – 21stC Maritime Security Trends

"Cyber @ Sea"

Ship: SS Nevasa – "School Cruise – April 1967"
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138

GPS Spoofing: Ship AIS/ECDIS – June 2017

Black Sea: 44°14.0'**N** 037°43.1**E**

(map labels: Crimea, Azov Sea, Russia, Novorossiysk, etc.)

20+ Black Sea Ships near *Novorossiysk* reported *"Spoofed* GPS Co-ordinates"

AIS = Automatic Identification System   :   **ECDIS** = Electronic Chart Display and Information System
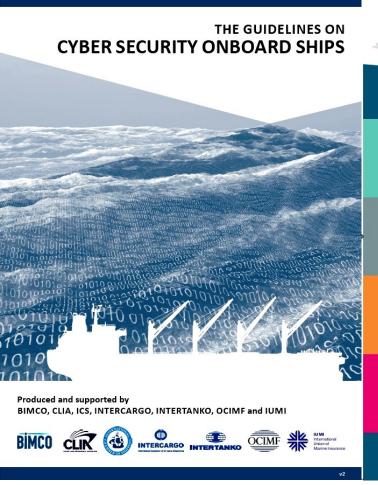
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Guides to *"Maritime CyberSecurity"*

THE GUIDELINES ON
CYBER SECURITY ONBOARD SHIPS

Produced and supported by
BIMCO, CLIA, ICS, INTERCARGO, INTERTANKO, OCIMF and IUMI

BIMCO · CLIA · INTERCARGO · INTERTANKO · OCIMF · IU MI International Union of Marine Insurance

v2

CYBER SECURITY ONBOARD SHIPS

Cyber security is everybody's responsibility.
The information provided here gives advice on how your actions can help to avoid cyber incidents.

POTENTIAL THREATS
KEEP UNAUTHORISED SOFTWARE AWAY FROM SHIP SYSTEMS!
- Scan for viruses and malware before you connect authorised USB memory sticks to onboard OT and other networked systems.
- Personal laptops, tablets, USB memory sticks or phones must not be connected to onboard operational systems.

INCIDENTS
BE PREPARED!
- Keep your crew and any passengers safe – train for what to do if important OT systems do not work.
- Know where to get IT and OT assistance.
- Report suspicious or unusual problems experienced on IT and OT systems.

PASSWORD PROTECTION
BE IN CONTROL!
- Use new passwords every time you sign on to a ship.
- Choose complex passwords with num6er5s, $ymbo!s, and some CaPiTaL letters. Be careful, you have to be able to remember them.
- Keep your user names and passwords to yourself.
- Change default user passwords and delete user accounts of colleagues who have left the ship.

SUSPICIOUS ACTIVITY
BE VIGILANT WHEN YOU COMMUNICATE!
- Only open emails or open attachments from senders that you know and trust.
- Know what to do with suspicious emails.
- Think before you share information on social media or personal email about your company, job, ship or the crew.

BIMCO · MPA SINGAPORE

OT: Operational Technology is the systems which are used to operate the ship.
IT: Information Technology is the systems used for office work, email and web-browsing.

IET Standards
[dstl] | Department for Transport

Code of Practice
Cyber Security for **Ships**

In-Depth *"Maritime CyberSecurity"* Publications from *"BIMCO"* & the *"IET"* – 2017

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140

"BIMCO"

Guidelines for CyberSecurity Onboard Ships

Identify threats

Understand the external cyber security threats to the ship.

Understand the internal cyber security threat posed by inappropriate use and lack of awareness.

Identify vulnerabilities

Develop inventories of onboard systems with direct and indirect communications links.

Understand the consequences of a cyber security threat on these systems.

Understand the capabilities and limitations of existing protection measures.

Respond to and recover from cyber security incidents

Respond to and recover from cyber security incidents that are realised using the response plan.

Assess the impact of the effectiveness of the response plan and re-assess threats and vulnerabilities.

Cyber security approach

Assess risk exposure

Determine the likelihood of vulnerabilities being exploited by external threats.

Determine the likelihood of vulnerabilities being exposed by inappropriate use.

Determine the security and safety impact of any individual or combination of vulnerabilities being exploited.

Establish contingency plans

Develop a response plan to reduce the impact of threats that are realised on the safety and security of the ship.

Develop protection and detection measures

Reduce the likelihood of vulnerabilities being exploited through protection measures.

Reduce the potential impact of a vulnerability being exploited.

July 2017

"BIMCO" = Baltic & International Maritime Council
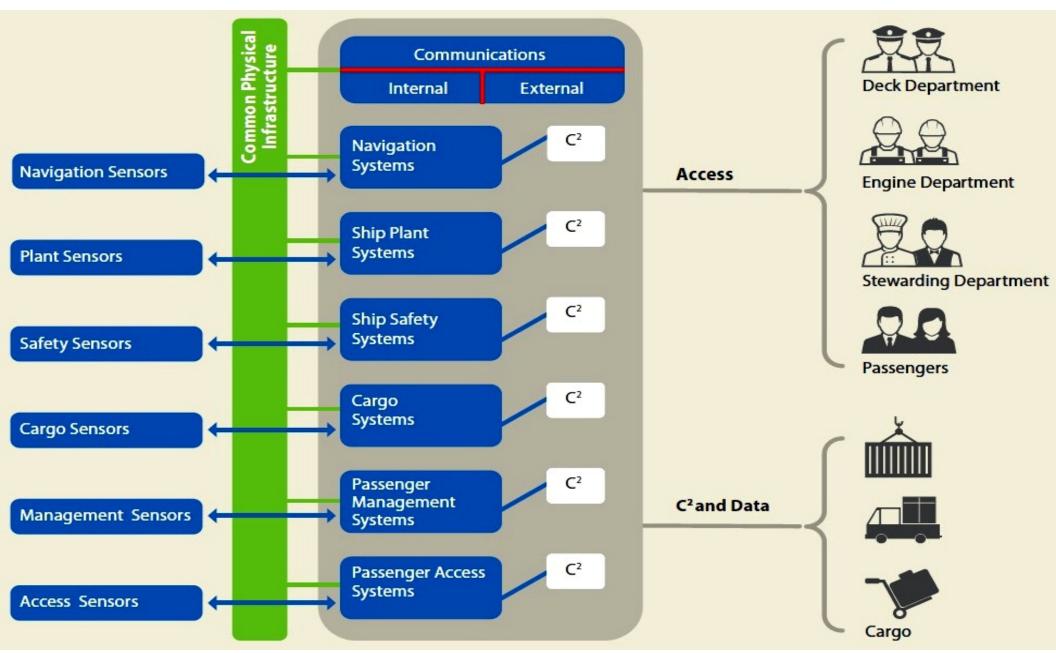
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IET: Code of Practice –"CyberSecurity For Ships"

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142

- Maritime Security in the "Southern Seas" - "Captain James Horsburgh" (1762 – 1836)

INDIA DIRECTORY,

OR,

DIRECTIONS FOR SAILING

TO AND FROM THE

EAST INDIES,

CHINA, AUSTRALIA, AND THE INTERJACENT PORTS

OF

AFRICA AND SOUTH AMERICA:

COMPILED CHIEFLY FROM

ORIGINAL JOURNALS OF THE HONOURABLE COMPANY'S SHIPS,

AND FROM

OBSERVATIONS AND REMARKS,

RESULTING FROM THE EXPERIENCE OF TWENTY-ONE YEARS IN THE NAVIGATION OF THOSE SEAS.

BY

JAMES HORSBURGH, F.R.S. R.A.S. R.G.S.

CORRESPONDING MEMBER OF THE IMPERIAL ACADEMY OF SCIENCES, ST. PETERSBURGH ; AND OF THE ROYAL SOCIETY OF
NORTHERN ANTIQUARIES, COPENHAGEN ; HYDROGRAPHER TO THE HONOURABLE EAST INDIA COMPANY.

They that go down to the sea in ships, that do business in great waters ; these see the works of the Lord,
and his wonders in the deep.—PSALM cvii. v. 23, 24.

VOLUME FIRST.

FIFTH EDITION.
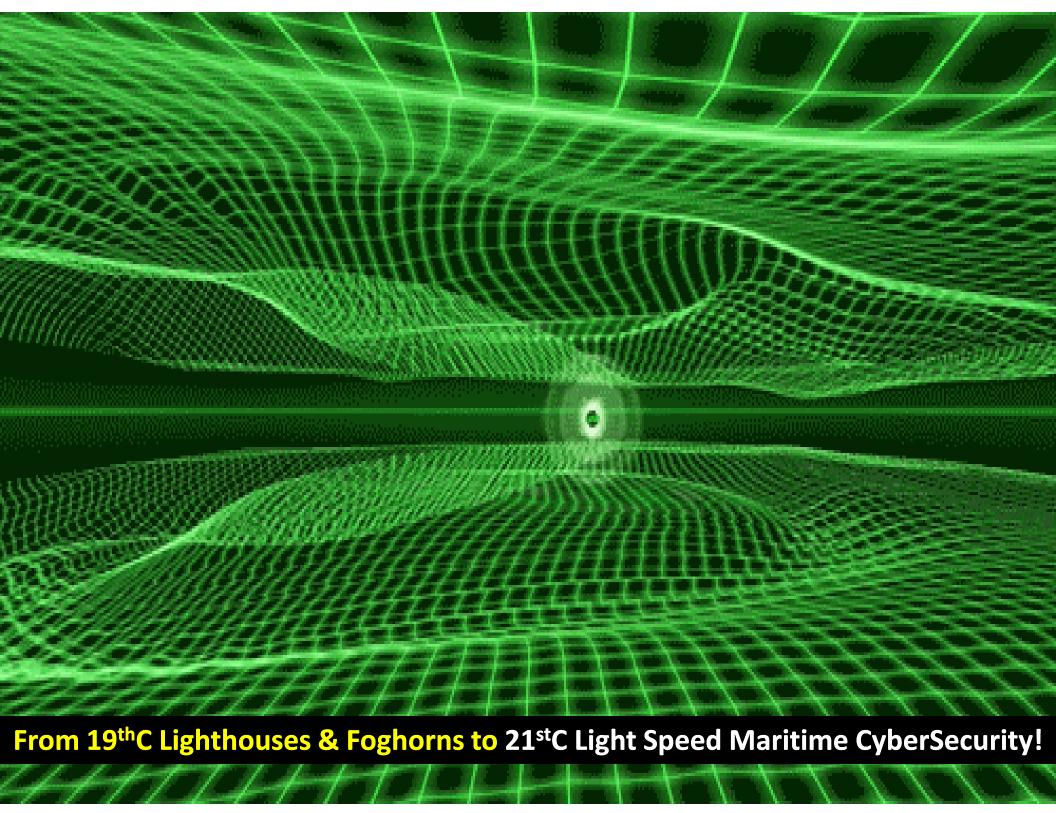
LONDON:

WM. H. ALLEN AND CO.,
Booksellers to the Honourable the East-India Company,
7, LEADENHALL STREET.

1841.

Horsburgh Lighthouse

- Singapore : 1851 -

From 19thC Lighthouses & Foghorns to 21stC Light Speed Maritime CyberSecurity!

*Cyber*Security 2018-2025 & *Beyond*!...

1-CyberCrime:CyberTerror:CyberWar **"OUR Cyber Society"**	2 – "TOP 10" Cyber Attacks & Threats **"YOUR Cyber Defence"**	3 –Scenario 2018: Cyber & Physical Tools **"Integrated Security"**
4 – Scenario 2019: Internet of Things-IoT **"Self-Adaptive"**	5 -Scenario 2020: Machine Learning **"Self-Learning"**	6 – Scenario 2025: Artificial Intelligence **"Cyber-Intelligent"**
7 –Scenario 2040: Artificial Silicon Life! **"Neural Security"**	8– 21stC Maritime Security Trends **"Cyber @ Sea"**	9 –Cyber VISION to Security NOW!.. **"NEW Cyber Toolkit"**

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9 – Cyber *Vision* to Security *NOW!*...

"NEW *Cyber* Toolkit"

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CyberSecurity: "21stC Neural Defence"

- "Bad Guys" are already deploying Advanced AI/ML CyberTools within Organised Crime Syndicates!

...**2018** (Integrated), **2019** (Adaptive), **2020** (Learning)

...**2025** (Intelligent Security) & **2040** (Neural Security)

Image: **David Shankbone**: Occupy Wall Street – Sept 2011

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CyberSecurity: "21stC Neural Defence"

- "Bad Guys" are already deploying Advanced AI/ML CyberTools within Organised Crime Syndicates!

- Legacy IoT Devices in *EVERY Sector* may be "hacked" & exploited with ease by Global Criminal "BotNets"!

- CyberDefence for Business & Government requires Managed 7 Year Transition to *"Speed of Light"* *"Neural Defence"* and *"Augmented Reality"*!

  ...We have *discussed our* **CyberSecurity Visions** for:

  ...**2018** (Integrated), **2019** (Adaptive), **2020** (Learning)

  ...2025 (Intelligent Security) & **2040** (Neural Security)

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7 Year CyberVision: "The New Toolkit"

- During the last 7 Years **CyberAttacks** targeted:
  - Critical National Infrastructure (CNI): Energy, Banks, Transport, Government, Healthcare, Education...
  - Major Events: Sports, Elections & Culture Festivals...
  - Criminal eCommerce: "The Dark Web" & "Silk Road"!

- The **"New Cyber Toolkit"** provides "Real-Time" Defence against "Zero-Day" & "Insider" Attacks!

- Exponential Increase in Device Connections (IoT) requires **Cyber Defence** through AI/ML "Bots" running 24/7 on ALL Networked System Assets!...

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149

"From 7 Year CyberVision to Reality!"

- 7 Year Evolution of Business **"$ecurity Culture"**
- **Cyber RoadMap** managed by Board-Level C$O
- Integrated Security with **Intelligent AI Alerts!**
- Professional **Cyber Training** for EVERY Business
- **"Sell"** Security Policy & Culture to ALL **"Staff"**
- **Trial and Deploy** Adaptive AI Security Solutions

.....**CyberSecurity** now requires **$$$** Investment in Teams & Technology to **Mitigate Major Risks!...**

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Guide to CyberSecurity Event Recovery:NIST

Recommended Technical Handbook: January 2017

Guide for Cybersecurity Event Recovery

NIST = National Institute of Standards & Technology

Michael Bartock
Jeffrey Cichonski
Murugiah Souppaya
Matthew Smith
Greg Witte
Karen Scarfone

This publication is available free of charge from:
https://doi.org/10.6028/NIST.SP.800-184

C O M P U T E R   S E C U R I T Y

Free Download: https://doi.org/10.6028/NIST.SP.800-184

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Guide to **CyberSecurity** Event Recovery:**NIST**

NIST Cyber Security Framework

Identify	Protect	Detect	Respond	Recover
Asset Management	Access Control	Anomalies and Events	Response Planning	Recovery Planning
Business Environment	Awareness and Training	Security Continuous Monitoring	Communications	Improvements
Governance	Data Security	Detection Processes	Analysis	Communications
Risk Assessment	Info Protection Processes and Procedures		Mitigation	
Risk Management Strategy	Maintenance		Improvements	
	Protective Technology			

Free Download: https://doi.org/10.6028/NIST.SP.800-184

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UK CyberSecurity Strategy: 2016 - 2021

HM Government

NATIONAL CYBER SECURITY STRATEGY 2016-2021

Defend – Deter - Develop

3. STRATEGIC CONTEXT

4. OUR NATIONAL RESPONSE

5. DEFEND

6. DETER

8. INTERNATIONAL ACTION

CONCLUSION: CYBER SECURITY BEYOND 2021

5 Year Programme Launched by UK Chancellor
Philip Hammond: **Tuesday 1st November 2016**

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CYBERSECURITY
www.VAZA.com
VAZA

Wrap-Up: CyberSecurity Landscape

- Convergence of Physical & Cybersecurity Operations

- "Cyber" migrates from IT Dept to Main Board: C-Suite

- Intelligent 24/7 "CyberAttacks" @ Mach 1 Million

- Transition from 20thC Tools (Firewalls & Anti-virus) to "Smart Real-Time" 21stC Tools (AI & Machine Learning)

- Emergence of Enterprise "Internet of Things" - IoT

- Evolution of Smart AI Devices, Economy & Society

- Massive growth in AI/ML "Cyber" Business StartUps!...

Now Design & Implement YOUR Business Plan for 21stC "Cyber"!...

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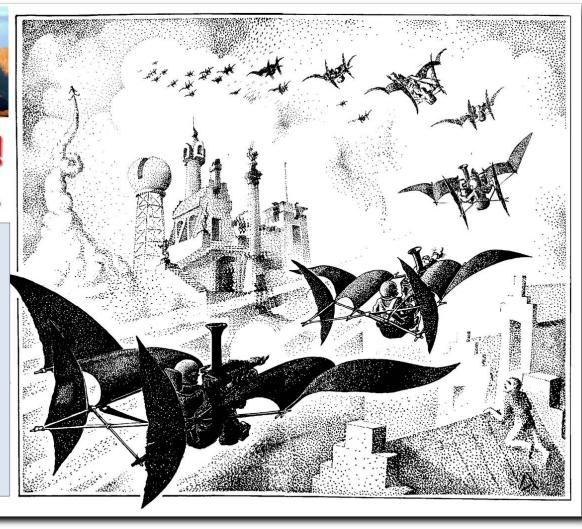
"Cyber Defence" against "Alien Invaders"

Cyber Threats & Defence!
- "Intelligent CyberSecurity" -

A.I. & Machine Learning CyberSecurity Tools will Provide *"Speed of Light"* Real-Time Defence against *TOP 10* Threats & Attacks!

"Steam Powered Birds arrive over our Cities! - 1981
Pen & Ink Drawing by **Dr Alexander Rimski-Korsakov**

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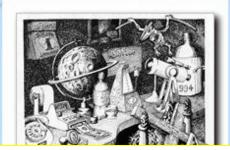
The Surrealistic Paintings of Dr Alexander Rimsky-Korsakov
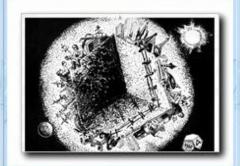
Web Link: www.valentina.net/ARK3/ark2.html

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"Maritime Cybersecurity" against Criminals & Terrorists

"19thC Ship in the Surrealistic Karelian Marshland" - 1968
Water Colour Painting by Dr Alexander Rimski-Korsakov

Web Link: www.valentina.net/ARK3/ark2.html
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Pen & Ink Painting by Dr Alexander Rimski-Korsakov :"**Navigating the Oceans & Hidden Threats**"

*Radium Institute Calendar - **2007** –St Petersburg*
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2007

* 1822–1871 *

Rear-Admiral Voin
Rimski-Korsakov
*Russian Navigator
& Hydrographer*
...Composer's Brother!

Pen & Ink Painting by Dr Alexander Rimski-Korsakov :"Navigating the Oceans & Hidden Threats"

Radium Institute Calendar - 2007 –St Petersburg
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ISSA Cybersecurity Security Conference: *London, UK*

Thank-You!

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ISSA Cybersecurity Security Conference: *London, UK*

Thank-You!

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BACK-UP SLIDES

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Additional *Cybersecurity* Resources

"Master Class - Smart Theory & Practice"	"Master Class 2012 - Smart Design"	"21stC Armenia- 2012: Smart Economy"	"21stC Armenia - 2012: Smart Security"	"21stC Armenia: Smart Governance"
"Real-Time Armenia" - White Paper	"Real-Time Armenia" - Slides	Awesome Armenia: In Photos	Roadmap for Real-Time Armenia- Report	RoadMap for Real-Time Armenia- Slides
"Real-Time Georgia" - GITI 2008 Slides	"Real-Time Georgia" - GITI 2008 Paper	Gorgeous Georgia: In Photos	21stC Georgia: "CyberVardzia" - Paper	21stC Georgia - "CyberVardzia" - Slides
			ITU/CITEL: Cybersecurity in the Americas	ITU/CITEL: Cybersecurity Skills Building

Link: www.valentina.net/vaza/CyberDocs

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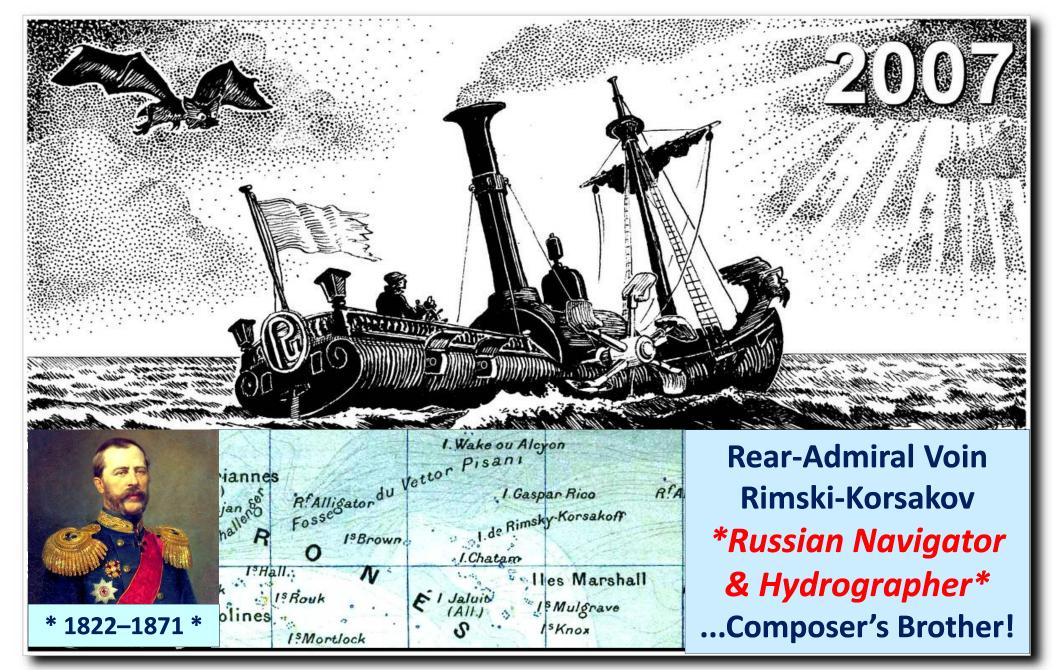© Dr David E. Probert : www.VAZA.com ©

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Ages of Computing, Networking & Intelligence: *1960 - 21stC*

Overview: Ages of Computing

Enterprise computing →

Team computing →

End user computing →

1960 → First age 'Big is beautiful' → 1975 → Second age 'Small is beautiful' → 1990 → Third age 'Enterprise on the desktop' → 21st century

First Age of Computing

1960 → 1975 - Convergence

- Physical explosion of size and power - 'Hierarchical Architecture'
- 'Big is BEAUTIFUL'
- Created commodity elements: MIPS and MBITS
- Focus on DATA - a STATIC universe

Computing MIPS

Communications MBITS

Functional Convergence of Components

Second Age of Computing

1975 → 1990 - Bridge

- Emergence of Networking Architecture - 'Distributed Architecture'
- 'Small is BEAUTIFUL'
- Created Open Systems: OSI
- Focus on INFORMATION - a DYNAMIC Universe

Components → BRIDGE → Applications

Third Age of Computing

1990 → 2005 - Focusing Lens

- Biological Explosion of Intelligence - 'Organic Architecture'
- 'Enterprise on the DESKTOP'
- Focus on KNOWLEDGE - a SELF-ORGANISING Universe

Information → Knowledge for Decision and Action!

From: "Business Blueprint": Probert – July 1989

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Main *Cyber* Players and their Motives

- *Cyber Criminals:* Seeking commercial gain from hacking banks & financial institutions as well a phishing scams & computer ransom ware

- *Cyber Terrorists:* Mission to penetrate & attack critical assets, and national infrastructure for aims relating to political power & "branding"

- *Cyber Espionage:* Using stealthy IT Malware to penetrate both corporate & military data servers in order to obtain plans & intelligence

- *Cyber Hackivists:* Groups such as "Anonymous" with Political Agendas that hack sites & servers to virally communicate the "message" for specific campaigns

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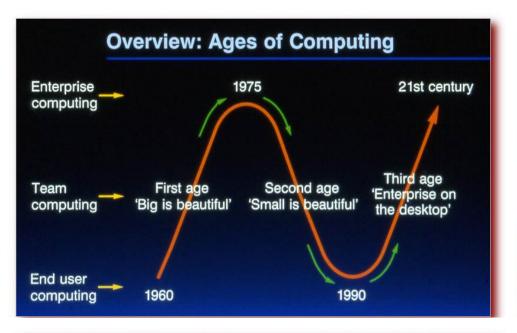**"21stC CyberSecurity Defence & Trends"**
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CyberSecurity: Market Sectors

- Anti-Virus/Firewall
- ID Authentication
- Encryption/Privacy
- Risk & Compliance
- Mobile Device Security
- Anti-Fraud Monitoring
- Website Protection
- S/W Code Verification

- AI & Machine Learning
- Enterprise IoT Security
- Cloud Security Services
- Big Data Protection
- RT Log/Event Analytics
- Real-Time Threat Maps
- Smart Biometrics
- Training & Certification

Global Trend is towards *Adaptive & Intelligent Cybersecurity Solutions/Services*...
....Traditional *Anti-Virus/Firewall Tools* no longer fully effective against *"Bad Guys"*!

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Critical Sectors: *Cyber Threat Scenarios*

- *Hybrid* Cyber-Physical Security Threats **will** target ALL of *YOUR* Critical Business and Government Sectors!....

a) **Finance & Banking** – ATMs, Fraud, Money Laundering

b) **Transport Hubs & Tourism** – Airports, Ships, Trains.....

c) **Energy & Utilities** – Nuclear, Chemical & Water Resources

d) **Government & Defence** – Intel Theft, Hacking, Military

e) **Education & Research** – Campus-Wide Armed Attacks

f) **Industry & Manufacturing** – Competitive Espionage

g) **Retail, Sports & Culture** – Malls, Concerts, Olympics.....

....**CSOs** are advised to *URGENTLY* define practical
& effective action plans to mitigate such attacks!...

Towards 2025 : *"Smart Security Solutions"*

- The Application of Artificial Intelligence and Machine Learning allows us to develop *"Smart Security Solutions"* as follows:

……..”Smart Security Solutions” typically possess the following features:

1) ***Space-Time Awareness:*** Location (GPS) & Real-Time Clocks
2) ***Learning, Adaptation & Self-Organisation:*** Real-Time Intelligence
3) ***Massive Memory & Storage:*** Local & Remote Cloud Storage
4) ***Sustainability:*** Embedded Security – *Everywhere in the Network!*
5) ***Scalable Networked Architecture:*** Smart Architectures will need to scale in space & time from micro cells to macro solutions
6) ***Decision Focus:*** "Knowledge Lens" for Data Mining & "Big Data" from Global Social Networks, Search & On-Line Trade & Commerce
7) ***Systems Integration:*** Cyber and Physical Solutions & Operations

………Now we'll consider how "AI & Machine Learning" principles are being engineered into 21stC Cybersecurity Solutions & Services…

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Building our 2025 Smart Security Toolkit
(1) Smart Decision Principles - "D-Genes"

- **Business Decisions** require focusing & filtering of Big Data sources in *Space-Time* to create local knowledge (Data Mining). Hence a useful metaphor is the *"Knowledge Lens"*:
  - Smart Decision *"Genes"* = Space, Time and Information Focus
  - Conceptual *"Knowledge Lens"* can filter and focus information in "Space" from searching Big Data Sets to a Small focused Short-List
  - The *"Knowledge Lens"* can focus information & present in real-time, possibly as an stream of multi-media news or market intelligence

- *"Knowledge Lens":* This concept can be a useful architectural principle in the design of *Smart Security*, Smart Business & Smart Governance

....21stC Cyber Attacks occur in Real-Time @Optical Speeds
so ultra fast analysis, decisions and action is a must!

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Building our 2025 Smart Security Toolkit
(2) Smart *Learning* Principles - *"L-Genes"*

- **Smart Learning** requires: Self-Organisation, Adaptation, Memory and Scalable Architecture. The Decision "Genes" are relatively traditional whilst these new Learning "Genes" lie at the heart of Smart Security.

  - **Self-Organisation** & Adaptation are essential principles of living systems and communities which include the well known self-organisation of insect roles in communities such as ants & bees.

  - **Cellular Automata** demonstrate relatively complex behaviour from simple mathematical rules, as in Conway's "Game of Life"

  - **Simple Dynamic Recursive Maps** such as x => 4x(1-x) also result in complex chaotic behaviour as found in real world insect populations

  - **Scalable Architecture** is also an essential feature of plants & animal life & Mandelbrot's theory of Fractal Curves provides vivid examples.

- **....Current Trends:** Research into AI, Machine Learning, Self-Organisation & Adaptation remains highly active in both Universities & Commercial R&D Labs

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2025 : Designing "*Smart Security*"

- **Smart Security Solutions** all use combinations of these Basic ICT Learning & Decision "genes" shared with Intelligent Living Systems:

  1) *Hybrid Organisation:* Hierarchical (Pyramid) & Organic (Networked)

  2) *Smart Decision Principles (D-Genes):* Space, Time & Decision Focus

  3) *Smart Learning Principles (L-Genes):* Memory, Scaling & Adaptation

  4) *Smart Security Solutions and Services:* Integration of Decision and Learning "Genes", within Secure & Resilient Systems Environment

  .....Using "AI & Machine Learning", 21stC Cyber Ventures are now marketing "Smart" Self-Learning Cybersecurity Tools to secure Enterprises, Government & Critical Information Infrastructure!

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"In-Depth 21stC Technical **Cyber Defence**"

- Effective **Cyber Defence** to **TOP 10 Threats** requires BOTH **Technical** & **Operational** Plans:

- Technical Actions, Plans & Policies include:
  - **DataBase:** Secure Physical & Cloud DataBase Scripts
  - **Back-Ups:** Continuous Real-Time DB/Web Back-Ups
  - **BYOD:** Strict Policy for "Bring Your Own Device"
  - **eMail:** Script Locks on eMail Attachments & Web Links
  - **DDoS:** Switch DNS/IP Settings in case of DDoS Attack
  - **CERT:** Set-Up Computer Emergency Response Team

    ......**CERTs** work together **Globally** to provide **Cyber Alerts & Intelligence** to Govt & Business

173
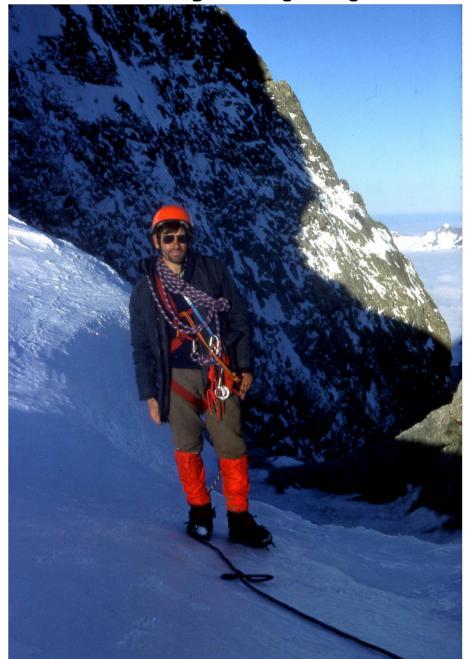
Cybersecurity & eGov Missions: 2009-2012
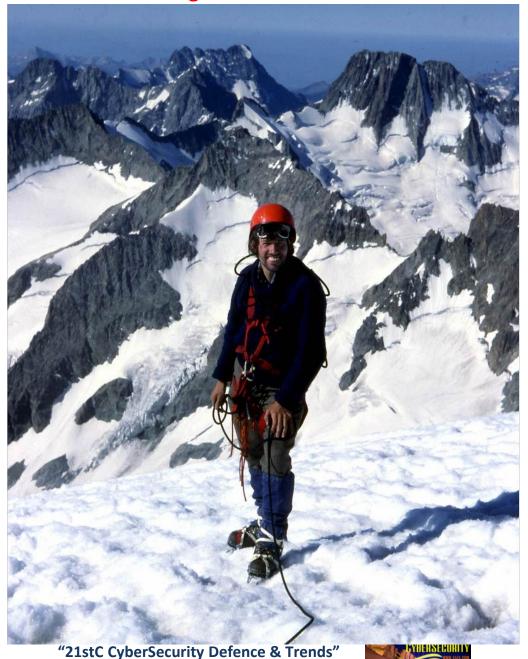## *Mt Aragats – South Summit(3879m): Armenia*

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Security Equipment for *Alpine Ascents*

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*** Security Equipment for Alpine Climbing ***

Sunrise on « Barre des Écrins » – 4102metres

Security Equipment includes: *50m Rope, Steel Crampons, Ice-Axe & Screws, Karabiners, Helmet...*

15th Sept 2015: « 7 Alpinistes killed in Avalanche »

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YOUR TOP 10 Actions & RoadMap

1) Assign CSO – Chief Security Officer with Strategic Security Action Plan

2) Professional CyberSecurity Training to International Certification - CISSP

3) Implement International Security Standards (ISO/IEC- Biometrics)

4) Open Discussions with "Cyber" Vendors and Trial AI/ML Tools

5) Profile YOUR Security Staff and Contractors for Possible Risks

6) ICT: Hire Qualified Cybersecurity Systems Technology, Software & Operations Team

7) Review Security Risks & Connectivity of ALL Enterprise IP Legacy Assets & Devices (IoT)

8) Design Practical Multi-Year Roadmap for Strategic Operational Security Integration

9) Professional Association Membership for Team Networking & Skill Building - ISSA

10) Cyber Legal Protection – Check *Your* Legacy Contracts for "Cyber Theft" Trading Risks

Now *YOUR* Business will be Fully Fit to Defend against *"Smart" Cyber-Physical* Attacks!

ISSA Summer CyberSecurity Conference 2018

"21stC CyberSecurity Defence & Trends"
**** From 2018 - 2025 & Beyond! ****
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177