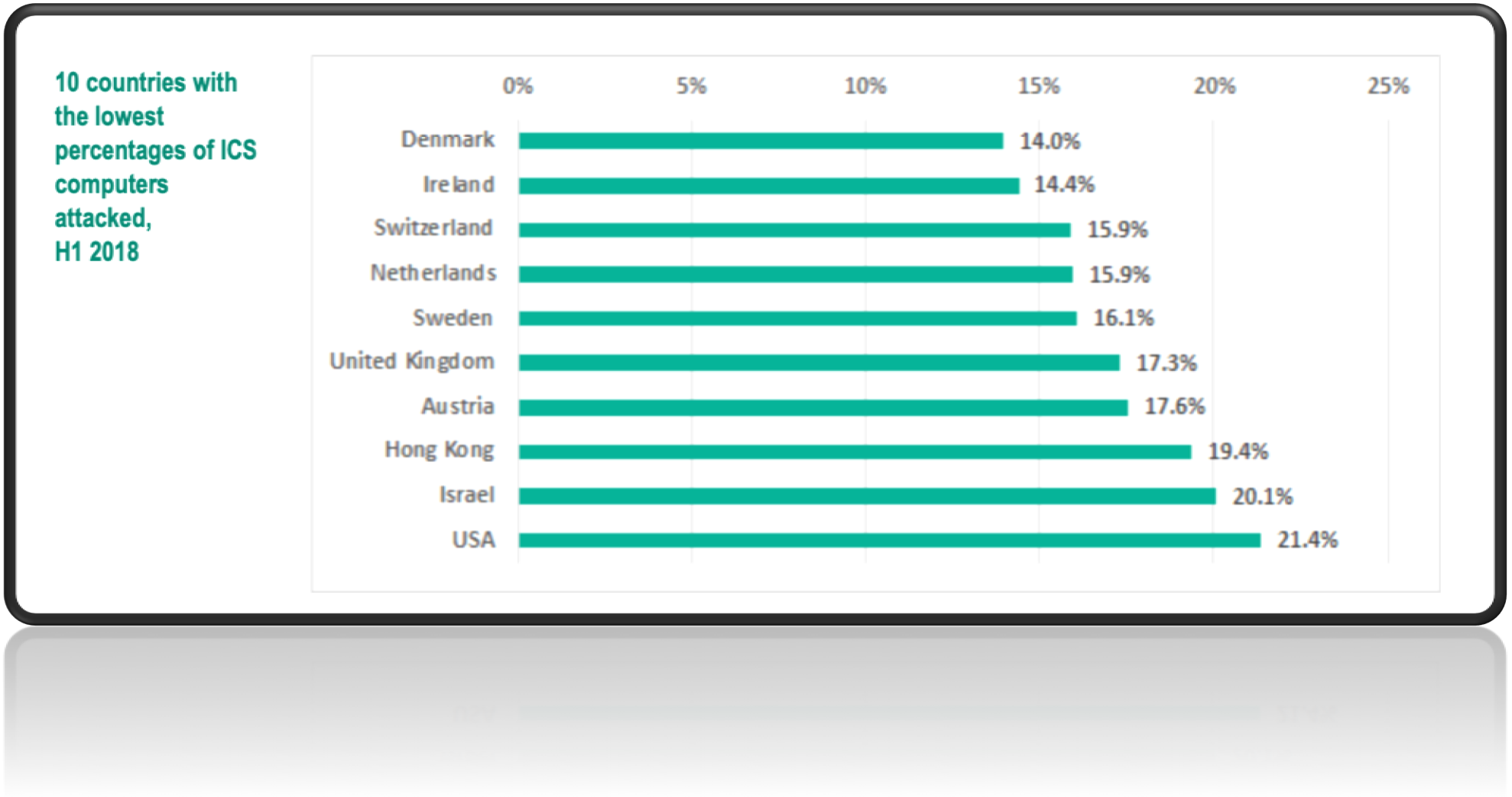
Visibility als erster Schritt zu sicheren OT Netzwerken

November, 2018

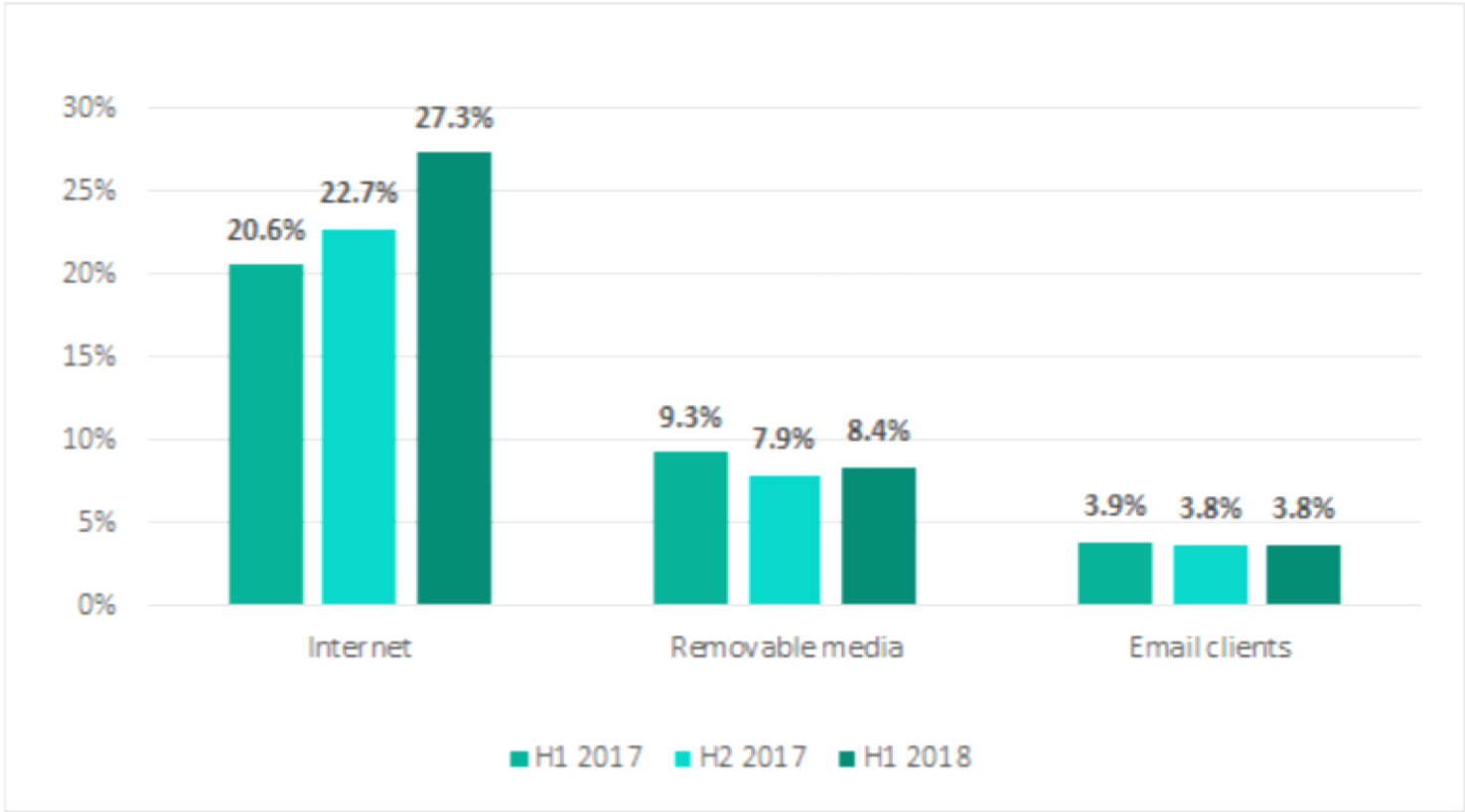
Markus Hirsch (mhirsch@fortinet.com)

Good News...?

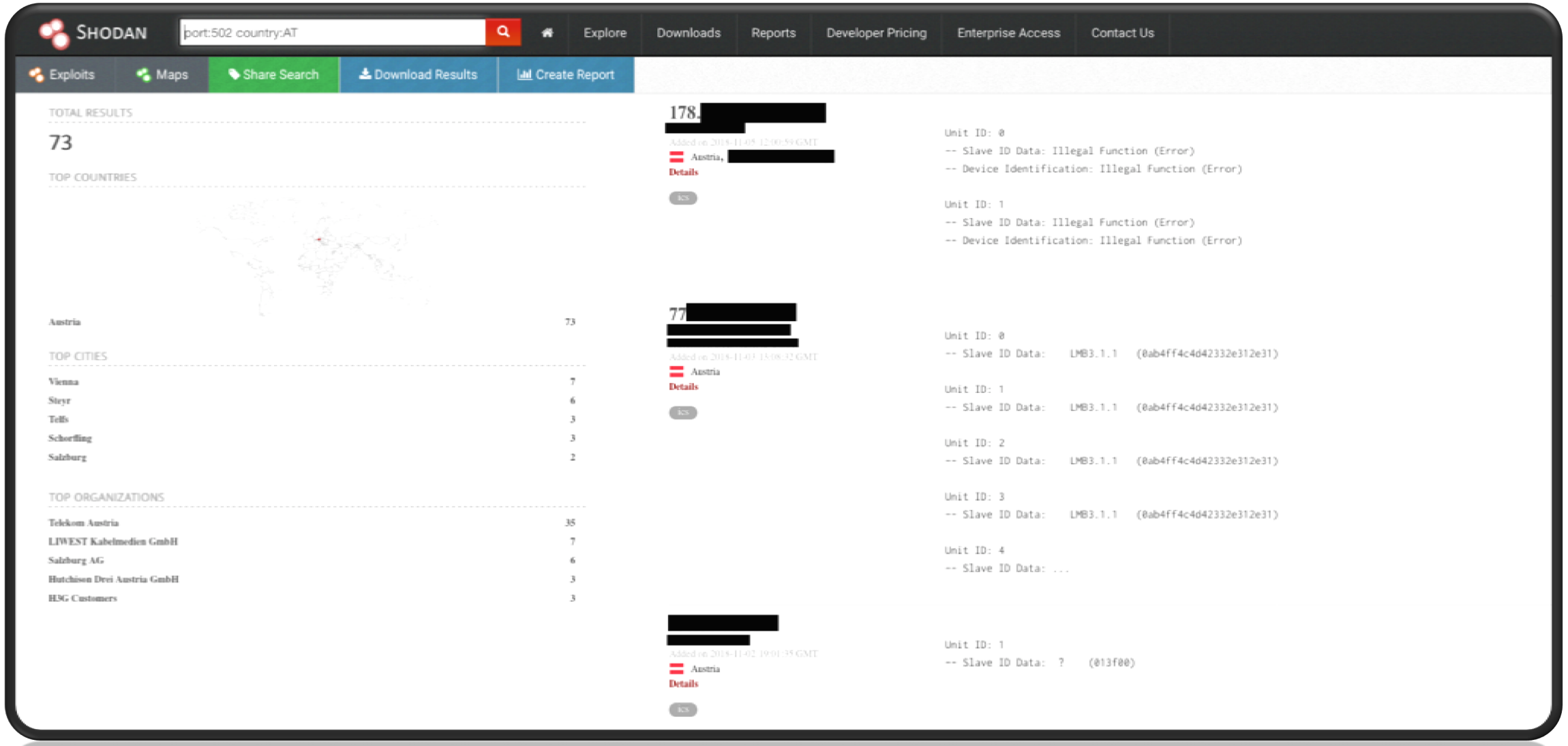


https://media.kasperskycontenthub.com/wp-content/uploads/sites/43/2018/09/06075839/H1_2018_ICS_REPORT_v1.0_ENG_05092018.pdf

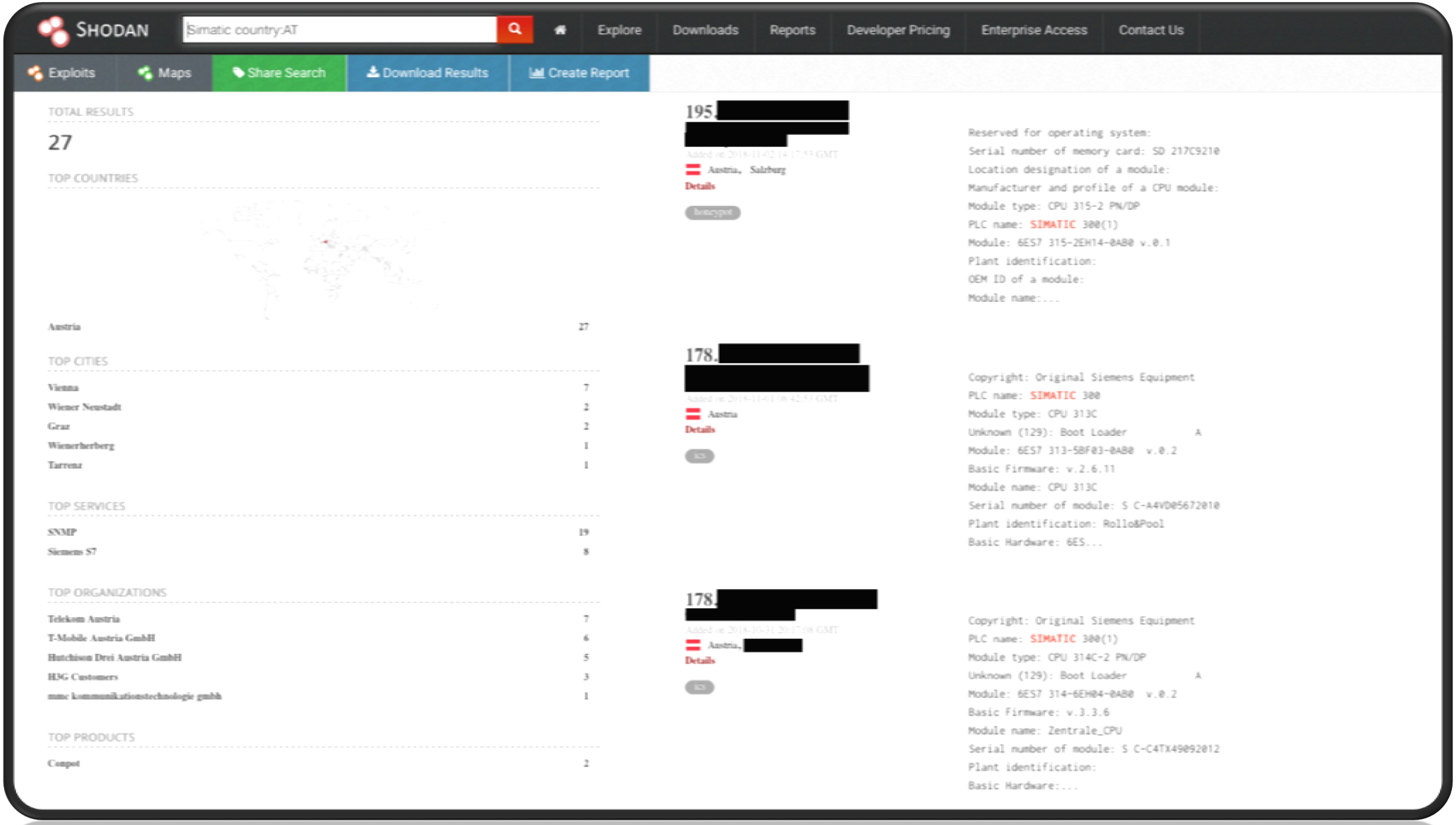
Main sources of threats blocked on ICS computers (percentage of computers attacked during half-year periods)



https://media.kasperskycontenthub.com/wp-content/uploads/sites/43/2018/09/06075839/H1_2018_ICS_REPORT_v1.0_ENG_05092018.pdf



https://www.shodan.io/



https://www.shodan.io/

https://www.infosecurity-magazine.com/news/hackers-say-windows-8-10-easiest

Pwned with '4 lines of code': Researchers warn SCADA systems are still hopelessly insecure

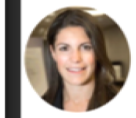
How Stuxnet, Shamoon, et al ran riot

By John Leyden 18 Jun 2018 at 09:43 66 SHARE

BSides London Industrial control systems could be exposed not just to remote hackers, but to local attacks and physical manipulation as well.

https://www.theregister.co.uk/2018/06/18/physically_hacking_scada_infosec/

Insecure SCADA Systems Blamed in Rash of Pipeline Data Network Attacks



Author:
Lindsey O'Donnell

April 4, 2018 / 10:12 am

2:30 minute read

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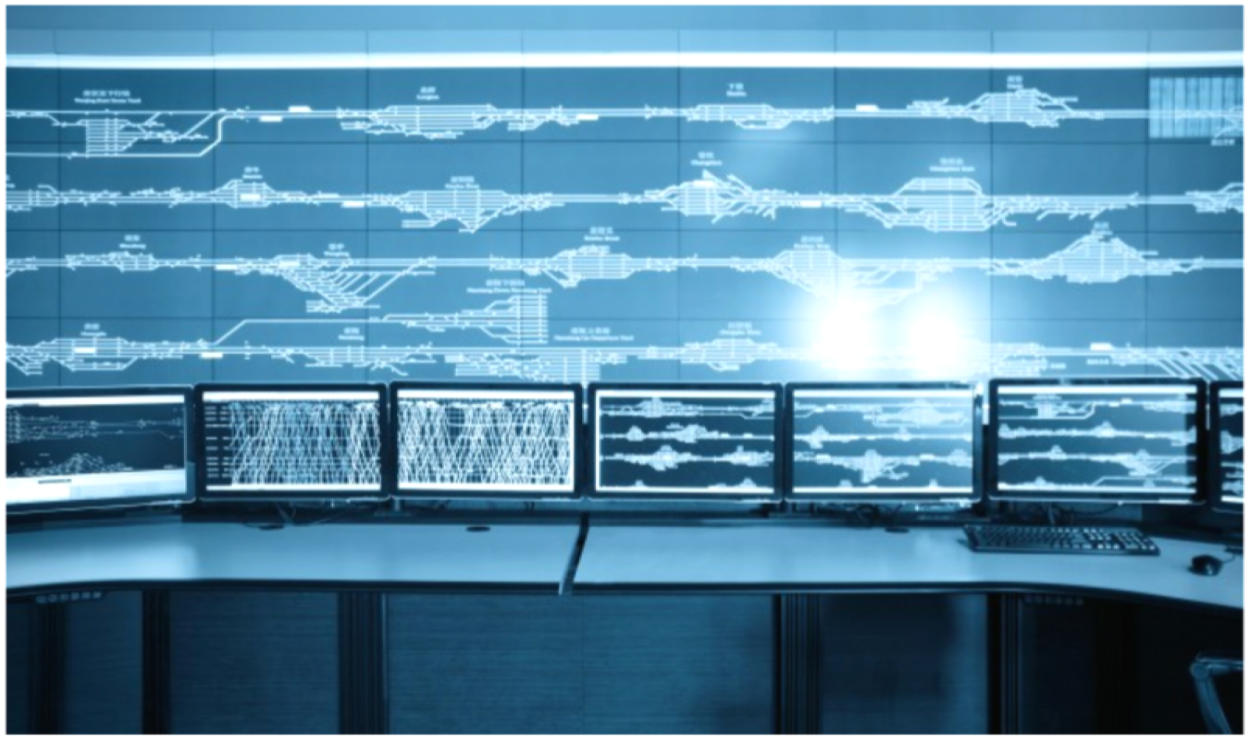


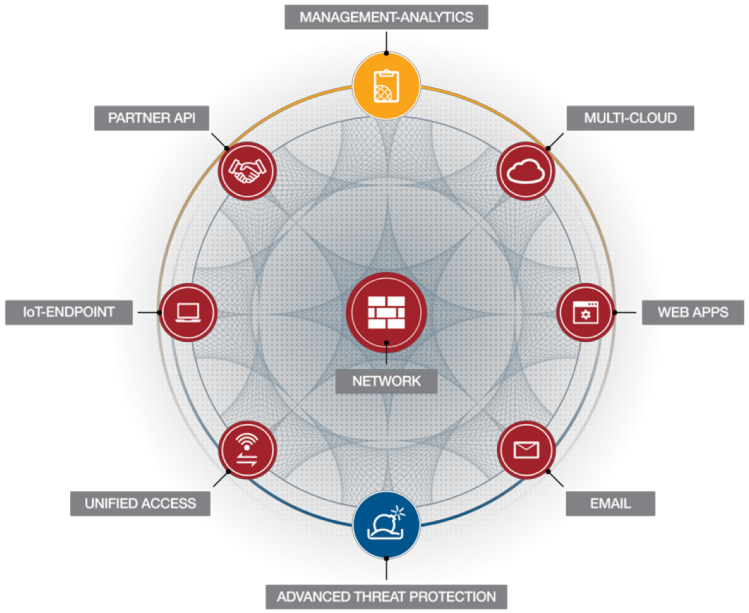
After a cyberattack shut down numerous pipeline communication networks this week experts are stressing the importance of securing third-party systems in supervisory control and data acquisition (SCADA) environments.

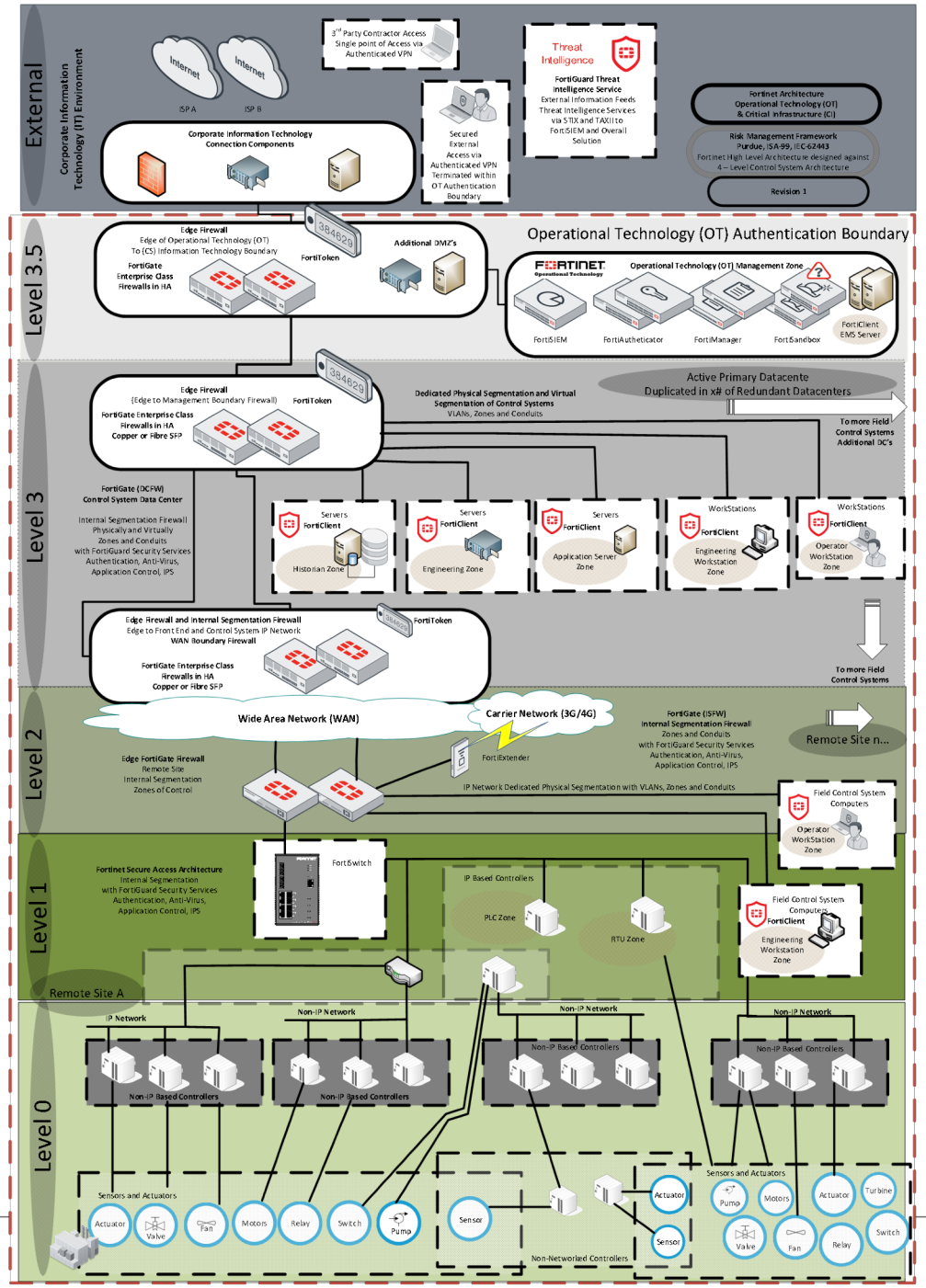
threatpost

https://threatpost.com/insecure-scada-systems-blamed-in-rash-of-pipeline-data-network-attacks/130952/

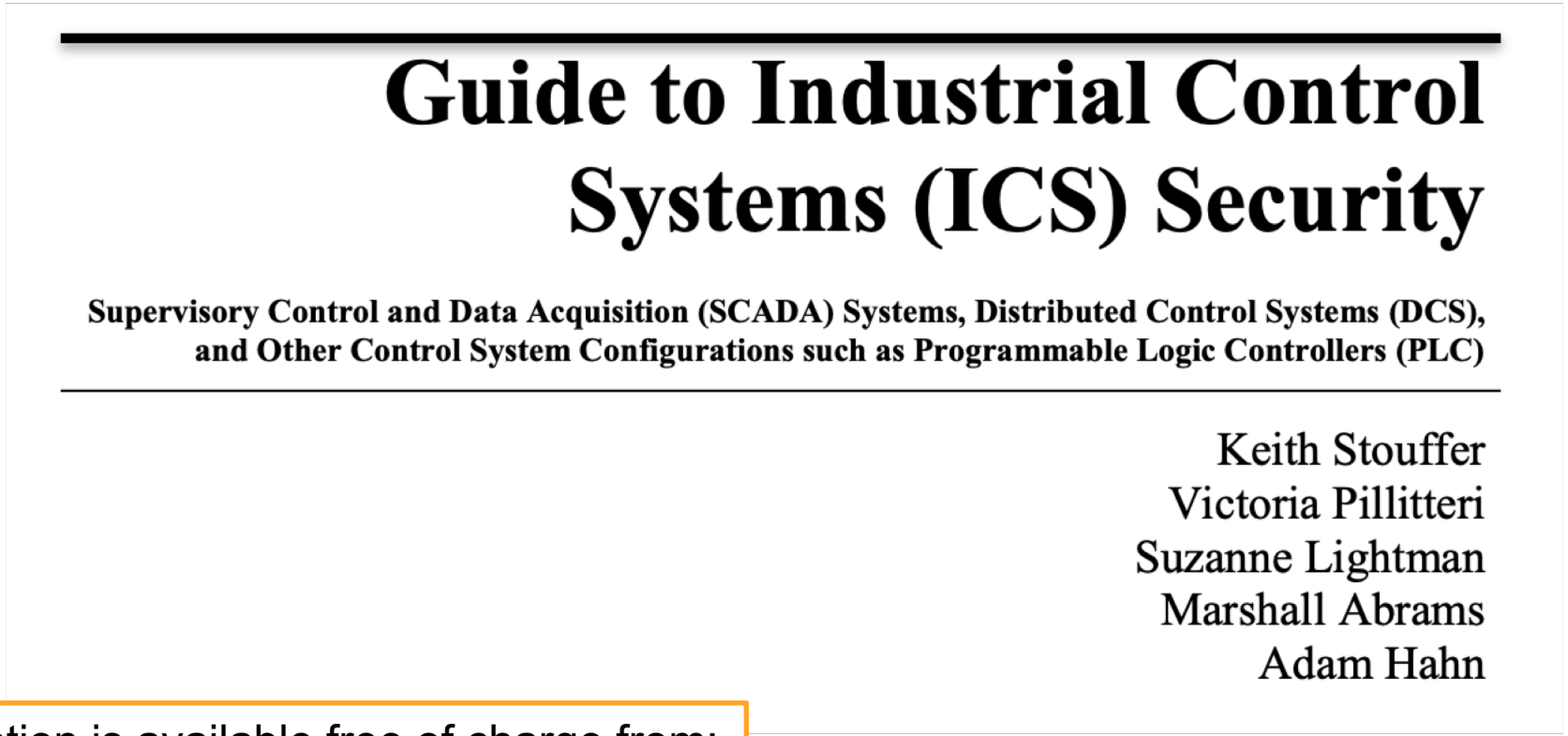
Purdue Model

- ISA-99, IEC-62443, RMF
- Effective Layered Security Model
- Aligns to Fortinet Fabric
- Logical Level Approach
- Focused on Business requirements





Strukturierte Herangehensweise

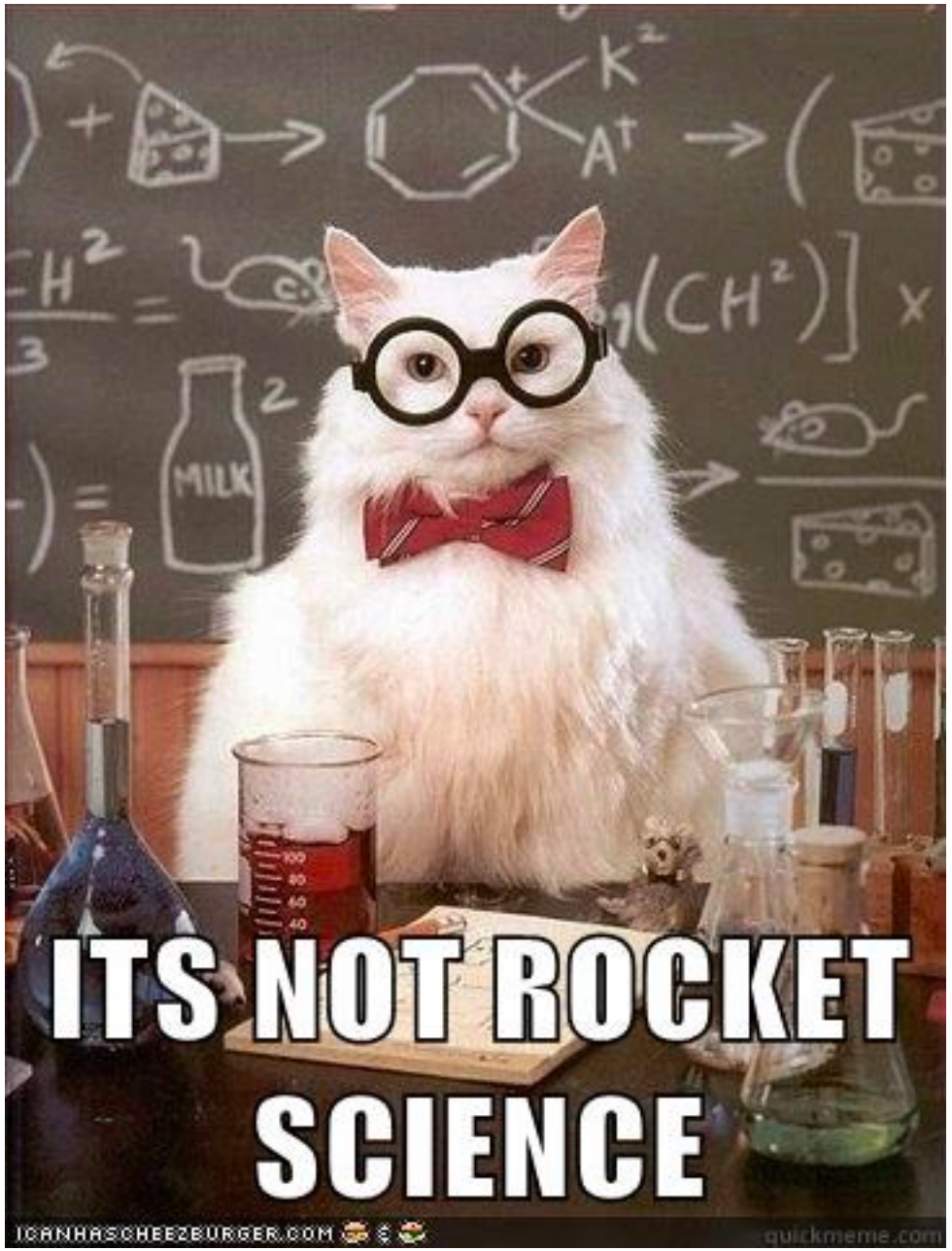


Guide to Industrial Control Systems (ICS) Security

Supervisory Control and Data Acquisition (SCADA) Systems, Distributed Control Systems (DCS), and Other Control System Configurations such as Programmable Logic Controllers (PLC)

Keith Stouffer
Victoria Pillitteri
Suzanne Lightman
Marshall Abrams
Adam Hahn

This publication is available free of charge from:
http://dx.doi.org/10.6028/NIST.SP.800-82r2 T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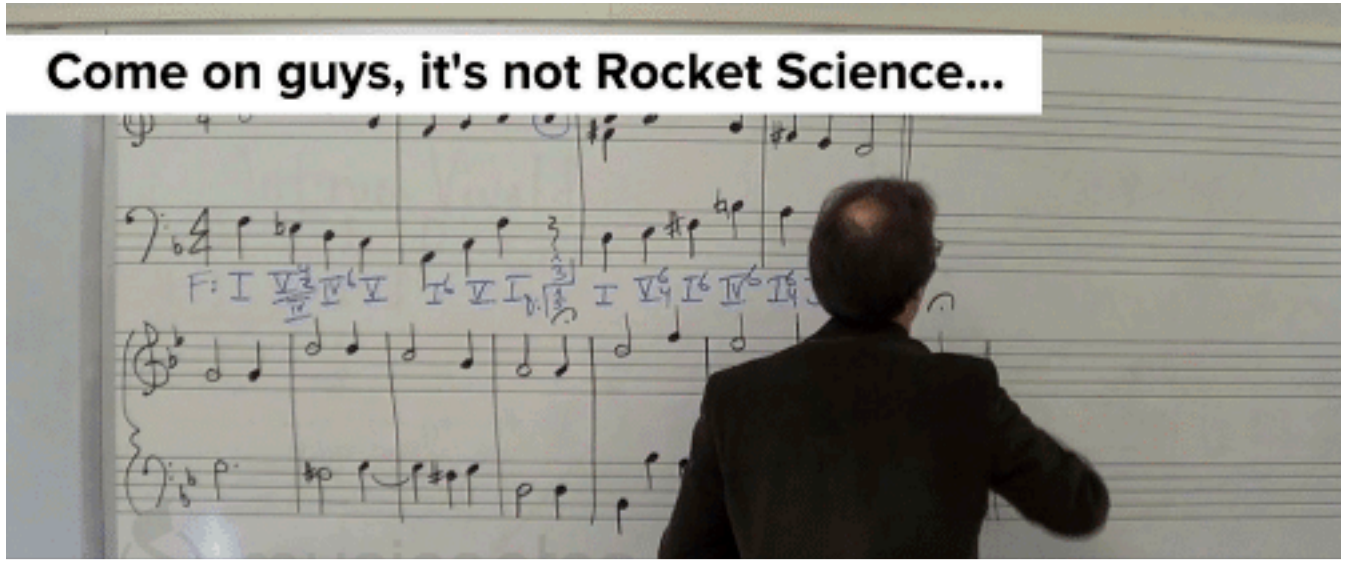
quickmeme.com

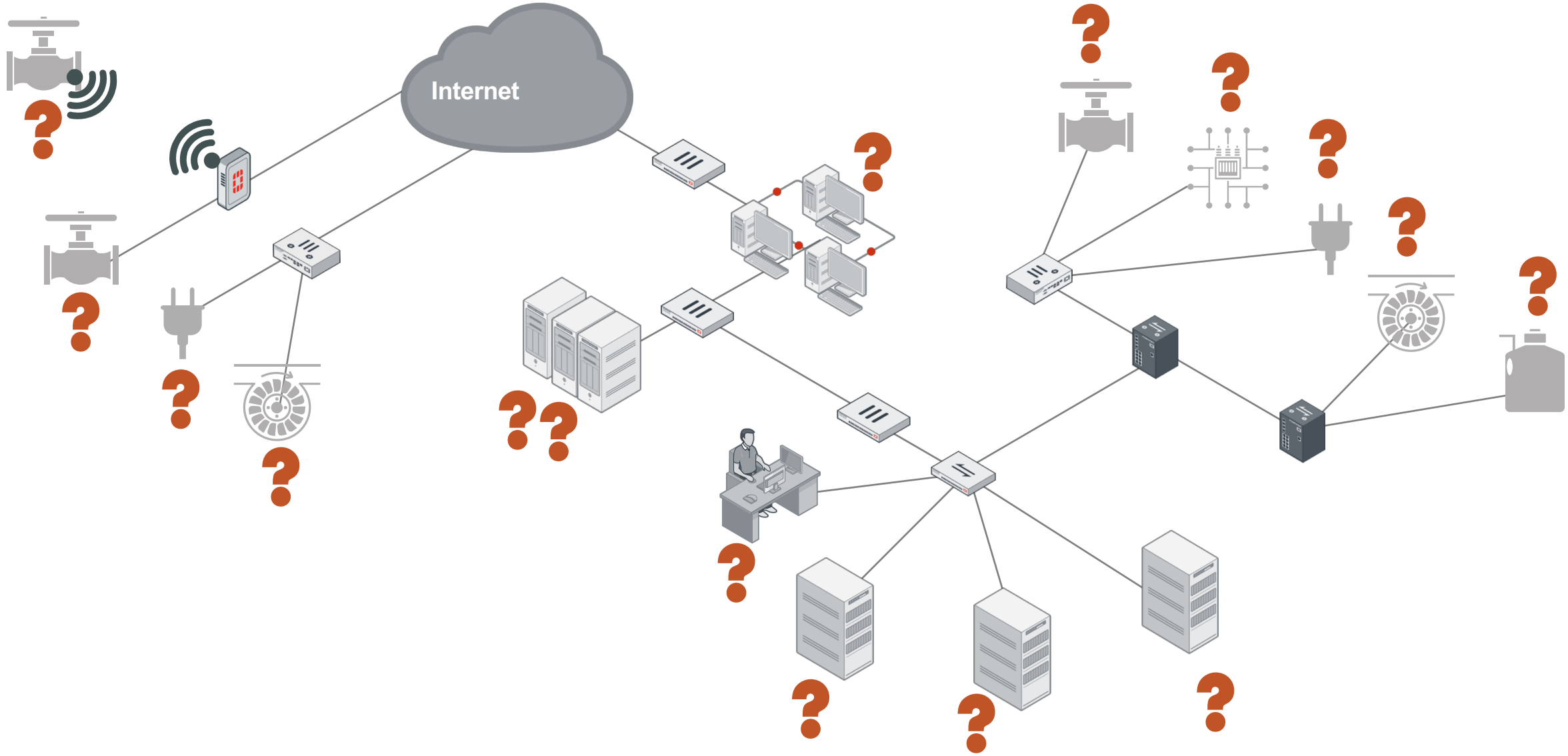
Strukturierte Herangehensweise

- 4.1 Business Case for Security
- 4.1.4 Presenting the Business Case to Leadership
- 4.4 Define ICS-specific Security Policies and Procedures
- 4.5 Implement an ICS Security Risk Management Framework
- 4.5.1 Categorize ICS Systems and Networks Assets
- 4.5.2 Select ICS Security Controls
- 4.5.3 Perform Risk Assessment
- 4.5.4 Implement the Security Controls

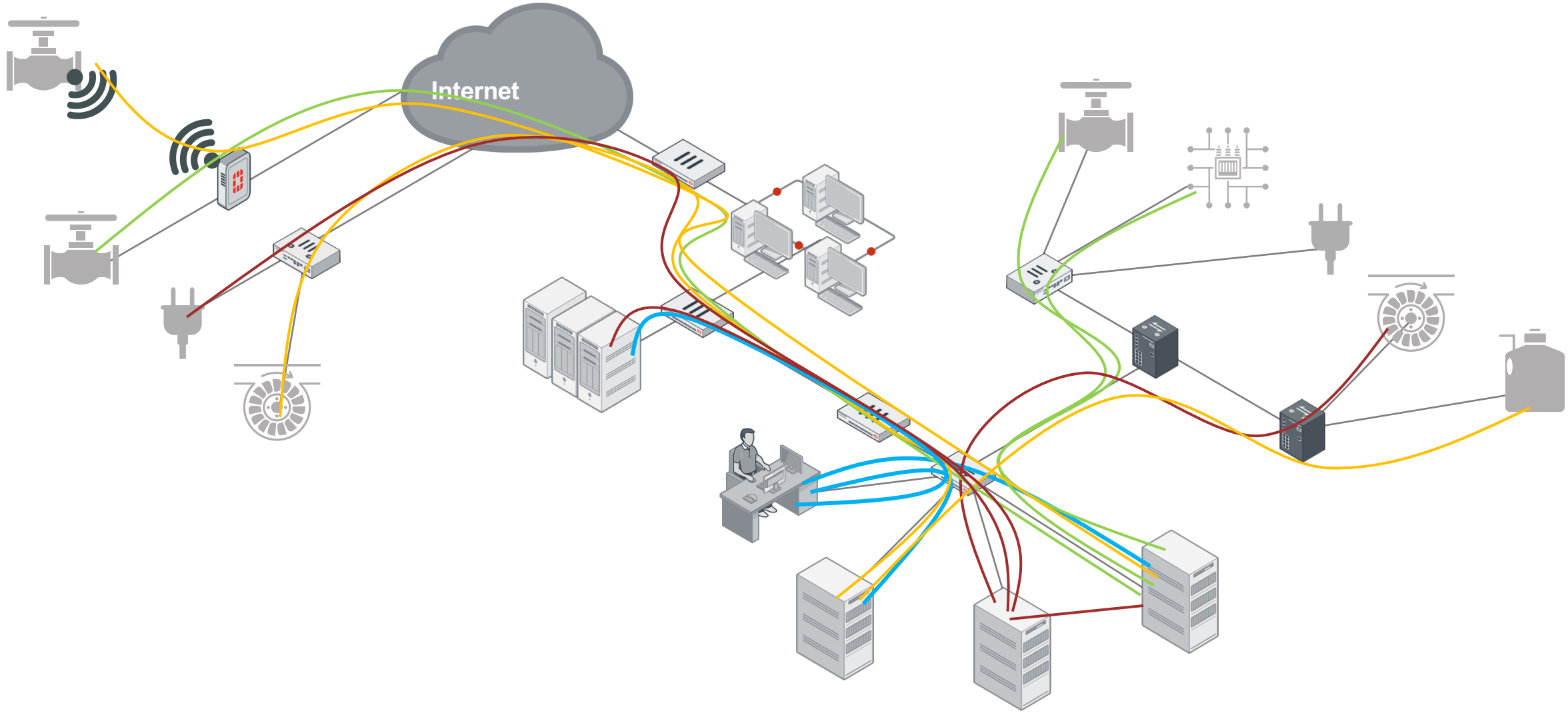


https://me.me/i/come-on-guys-its-not-rocket-science-1-3-1016-7-5-dcb4d82b649b4a788cf1002db5be1478

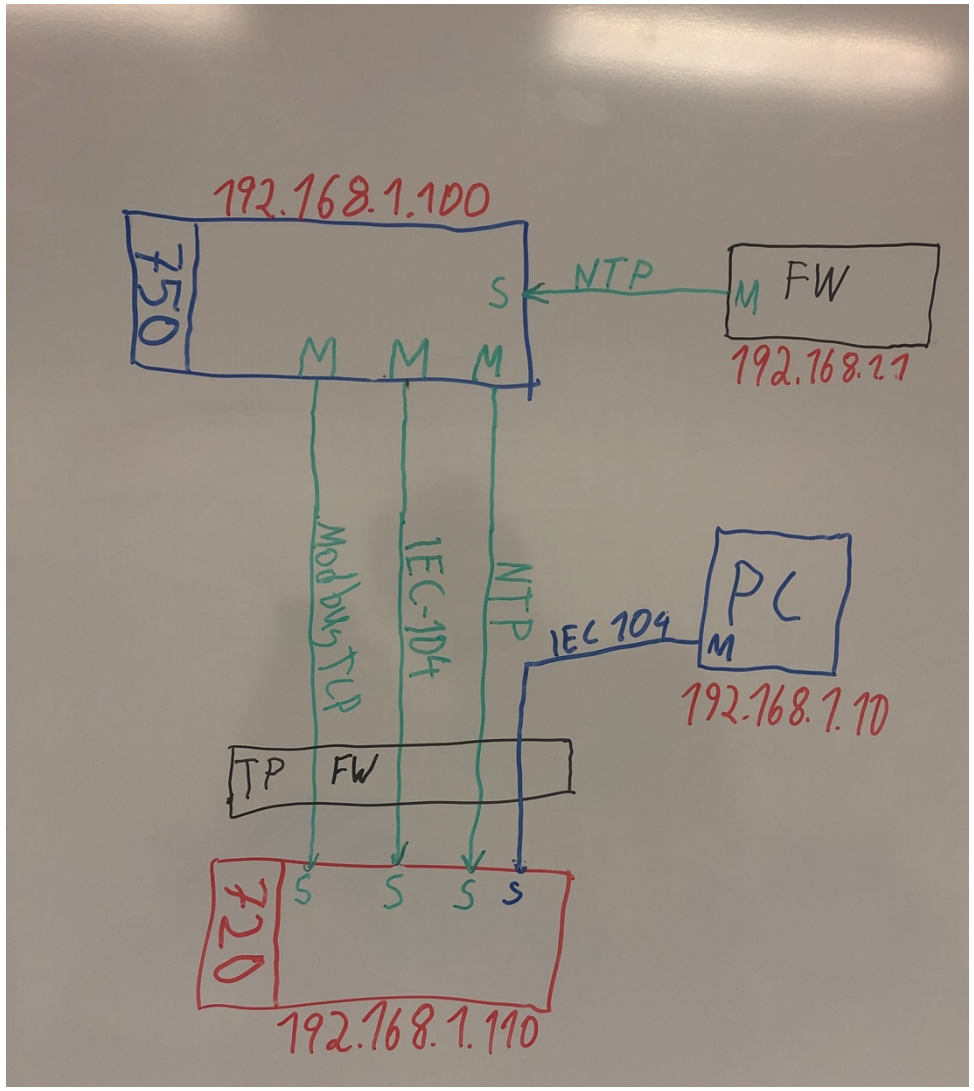
Schritt 1: Finde alle Geräte



Schritt 2: Erkenne die Kommunikationsbeziehungen



Wie alles begann...



OT Kommunikationsreport

Modbus Kommunikation

#	srcip	dstip	num_conn
1	192.168.1.100	192.168.1.110	95131

Modbus Kommunikationen mit Protokolldetails

#	srcip	dstip	
1	192.168.1.100	192.168.1.110	Modbus Modbus_Read.Input.Registers

Modbus Kommunikationen pro Server mit Protokolldetails

#	dstip	app__agg_
1	192.168.1.110	Modbus Modbus_Read.Input.Registers

IEC-140 Kommunikation

#	srcip	dstip	num_conn
1	10.0.1.1	10.0.2.1	183986
2	192.168.1.100	192.168.1.110	6440

IEC-104 Kommunikation mit Protokolldetails

#	srcip	dstip	
1	10.0.1.1	10.0.2.1	IEC.60870.5.104_Control.Functions.STARTDT.ACT IEC.60870.5.104_Control.Functions.STARTDT.CON IEC.60870.5.104_Information.Transfer IEC.60870.5.104_Information.Transfer.C.CS.NA.1 IEC.60870.5.104_Information.Transfer.C.IC.NA.1 IEC.60870.5.104_Information.Transfer.M.EI.NA.1 IEC.60870.5.104_Information.Transfer.M.ME.NC.1 IEC.60870.5.104_Information.Transfer.M.ME.TF.1 IEC.60870.5.104_Information.Transfer.M.SP.NA.1 IEC.60870.5.104_Information.Transfer.M.SP.TB.1 IEC.60870.5.104_Information.Transfer.Process.Monitor IEC.60870.5.104_Information.Transfer.System.Information IEC.60870.5.104_Supervisory.Functions
2	192.168.1.100	192.168.1.110	IEC.60870.5.104_Control.Functions.STARTDT.ACT IEC.60870.5.104_Control.Functions.STARTDT.CON IEC.60870.5.104_Control.Functions.TESTFR.ACT IEC.60870.5.104_Control.Functions.TESTFR.CON IEC.60870.5.104_Information.Transfer IEC.60870.5.104_Information.Transfer.C.CS.NA.1 IEC.60870.5.104_Information.Transfer.M.SP.TB.1 IEC.60870.5.104_Information.Transfer.Process.Monitor IEC.60870.5.104_Information.Transfer.System.Information IEC.60870.5.104_Supervisory.Functions

IEC-104 Kommunikationen pro Server mit Protokolldetails

#	dstip	app__agg_
1	10.0.2.1	IEC.60870.5.104_Control.Functions.STARTDT.ACT IEC.60870.5.104_Control.Functions.STARTDT.CON IEC.60870.5.104_Information.Transfer IEC.60870.5.104_Information.Transfer.C.CS.NA.1 IEC.60870.5.104_Information.Transfer.C.IC.NA.1 IEC.60870.5.104_Information.Transfer.M.EI.NA.1 IEC.60870.5.104_Information.Transfer.M.ME.NC.1 IEC.60870.5.104_Information.Transfer.M.ME.TF.1

Alle Kommunikationen pro Server mit Protokolldetails

#	dstip	app__agg_
1	10.0.2.1	IEC.60870.5.104_Control.Functions.STARTDT.ACT IEC.60870.5.104_Control.Functions.STARTDT.CON IEC.60870.5.104_Information.Transfer IEC.60870.5.104_Information.Transfer.C.CS.NA.1 IEC.60870.5.104_Information.Transfer.C.IC.NA.1 IEC.60870.5.104_Information.Transfer.M.EI.NA.1 IEC.60870.5.104_Information.Transfer.M.ME.NC.1 IEC.60870.5.104_Information.Transfer.M.ME.TF.1 IEC.60870.5.104_Information.Transfer.M.SP.NA.1 IEC.60870.5.104_Information.Transfer.M.SP.TB.1 IEC.60870.5.104_Information.Transfer.Process.Monitor IEC.60870.5.104_Information.Transfer.System.Information IEC.60870.5.104_Supervisory.Functions
2	192.168.1.1	NTP Unknown Application
3	192.168.1.100	NTP SSL SSL_TLSv1.2 Unknown Application
4	192.168.1.110	IEC.60870.5.104_Control.Functions.STARTDT.ACT IEC.60870.5.104_Control.Functions.STARTDT.CON IEC.60870.5.104_Control.Functions.TESTFR.ACT IEC.60870.5.104_Control.Functions.TESTFR.CON IEC.60870.5.104_Information.Transfer IEC.60870.5.104_Information.Transfer.C.CS.NA.1 IEC.60870.5.104_Information.Transfer.M.SP.TB.1 IEC.60870.5.104_Information.Transfer.Process.Monitor IEC.60870.5.104_Information.Transfer.System.Information IEC.60870.5.104_Supervisory.Functions Modbus Modbus_Read.Input.Registers

FortiGate Logs:

#	Source	Destination IP	Service	Application	Application Categ...	File Name
1	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
2	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
3	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
4	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
5	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
6	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
7	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
8	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
9	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
10	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02
11	192.168.1.1...	192.168.1.110	Modbus	Modbus_Read.Input.Registers	Industrial	01 90 00 02

Wireshark:

```
▶ Frame 2: 78 bytes on wire (624 bits), 78 bytes captured (624 bits)
▶ Ethernet II, Src: Ids_01:60:00 (00:12:ad:01:60:00), Dst: Ids_01:5d:7a (00:12:ad:01:5d:7a)
▶ Internet Protocol Version 4, Src: 192.168.1.100, Dst: 192.168.1.110
▶ Transmission Control Protocol, Src Port: 57456, Dst Port: 502, Seq: 1, Ack: 1, Len: 12
▼ Modbus/TCP
  ▶ [Expert Info (Warning/Protocol): Cannot classify packet type. Try setting Modbus/TCP Port pr
    Transaction Identifier: 35717
    Protocol Identifier: 0
    Length: 6
    Unit Identifier: 1
▼ Modbus
    .000 0100 = Function Code: Read Input Registers (4)

0000  00 12 ad 01 5d 7a 00 12  ad 01 60 00 08 00 45 00   ····]z·· ··`···E·
0010  00 40 b7 8d 40 00 40 06  ff 07 c0 a8 01 64 c0 a8   ·@··@·@· ·····d··
0020  01 6e e0 70 01 f6 0d c9  46 71 c5 bf f3 ff 80 18   ·n·p···· Fq·····
0030  01 12 52 dc 00 00 01 01  08 0a 00 bb 23 d0 1f 7a   ··R····· ····#··z
0040  dc 10 8b 85 00 00 00 06  01 04 01 90 00 02        ········ ·····
```

Rapid SCADA Modbus Parser
http://modbus.rapidscada.net/

Part of Data Package	Description	Value
8B 85	Transaction identifier	0x8B85 (35717)
00 00	Protocol identifier	0 = MODBUS protocol
00 06	Length	0x0006 (6)
01	Unit identifier	0x01 (1)
04	Function code	0x04 (4) - Read Input Registers
01 90	Starting address	0x0191 (401)
00 02	Quantity	0x0002 (2)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