CHAPTER 11

Tools and Programming

Episode 11.01 – Using Scripting with Pen Testing

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

SCRIPTING FOR PENETRATION TESTING

- Why bother with scripts?
  - Automate mundane/repetitive tasks
  - Faster
  - Less error prone
  - Repeatable
- What is a script?
  - Interpreted sequence of commands
  - Not compiled or assembled
  - Easy to code

COMMON SCRIPTING LANGUAGES

- Bash – Bourne Again Shell
  - Command shell for most Linux/MAC OS systems
  - Freely available version of the UNIX Bourne shell (sh)
- PowerShell – Windows-based admin and automation shell
  - Available in Windows since 2006
  - Powerful scripting language

COMMON SCRIPTING LANGUAGES

- Ruby – object-oriented high-level interpreted general purpose programming language
  - Influenced by Perl, Smalltalk, Ada, Lisp
- Python –object-oriented high-level interpreted general purpose programming language
  - Extensive available libraries
  - Great intro language

ADDITIONAL RESOURCES

- Bash
  - Curated list - https://github.com/awesome-lists/awesome-bash
  - https://www.commonexploits.com/penetration-testing-scripts/
  - https://github.com/averagesecurityguy/scripts
  - https://github.com/bitvijays/Pentest-Scripts
- PowerShell
  - https://www.businessnewsdaily.com/10760-best-free-powershell-training-resources.html
  - https://blog.netwrix.com/2018/02/21/windows-powershell-scripting-tutorial-for-beginners/

ADDITIONAL RESOURCES

- Ruby
  - https://www.ruby-lang.org/en/
  - https://hackr.io/tutorials/learn-ruby
  - http://ruby-for-beginners.rubymonstas.org/index.html
- Python
  - https://learnpythonthehardway.org/
  - http://shop.oreilly.com/product/9781597499576.do

SCRIPTING

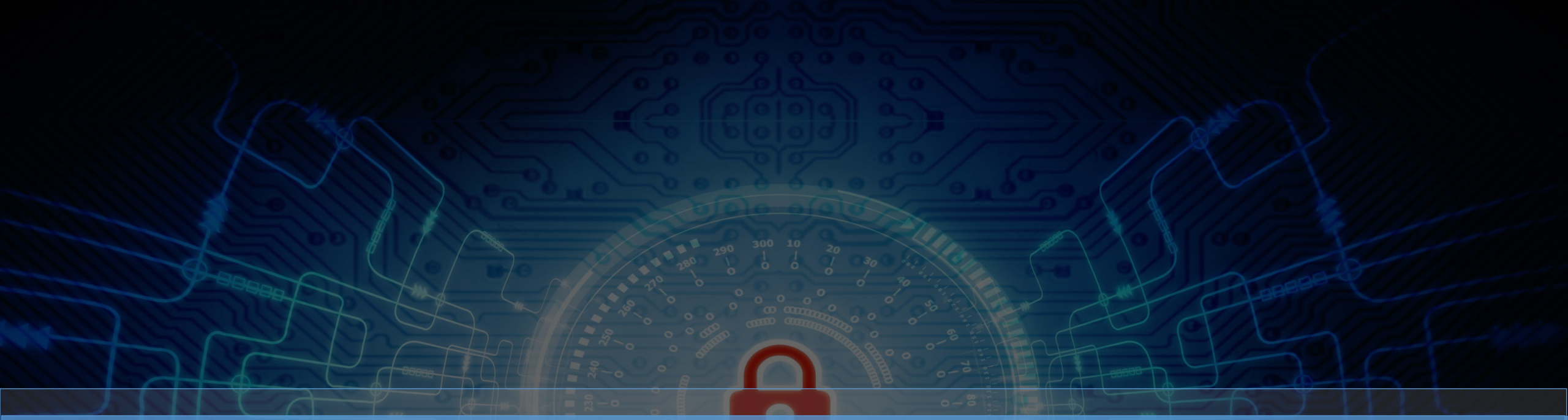
- Variables
  - Temporary data storage
- Substitutions
  - Input parameters and environment variables
- Common operations
  - Strings and comparisons
- Logic
  - Looping and flow control

SCRIPTING

- Basic I/O
  - Read input and write output (file, terminal, and network)
- Error handling
  - When things don’t work
- Arrays
  - Simple data structure
- Encoding/decoding
  - Handling special characters

QUICK REVIEW

- Scripts help automate repetitive actions
- Scripts are good for standardizing testing activities
- Scripts also reduce typing errors and make tests repeatable, as well as help in documenting test activities



Episode 11.02 Bash Scripting Basics

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

COMMENTS

- Help you remember what you were thinking
  - All comments start with the ‘#’ character
  - Anything after ‘#’ is ignored by the interpreter
  - Ex: # This is a comment

VARIABLES

- varName=value
  - Ex: name=Michael
- echo $name
- Common to read data into variables, as opposed to hard coding too much
- Bash variables are untyped

SUBSTITUTIONS

- “$” prefix refers to the contents of an identifier (ex. echo $name)
- Can refer to
  - Variables $name
  - Input parameters $1
  - Environment variables $PATH
  - Values from utilities $(whoami)

SUBSTITUTIONS

- And, bash will set defaults when no other value is provided

```
JAVAPATH=${JAVAHOME:=/usr/lib/java}
```

```
OUTPUTDIR=${1:-/tmp}    # IMPORTANT DIFFERENCE
```

COMMON OPERATIONS

- String operations
  - Concatenate var="Hello" ; var="$var World"
  - Length ${#string} OR expr length $string ex. ${#name}
  - Extract a substring echo ${string:position} ex. ${name:3}
  - Replacing substring ${string/substring/replacement} ex. ${name/ch/xx}
- Compound operations
  - AND: -a
  - OR: -o

COMPARISONS

- if [“$varA” –eq “$varB”]
- Equal: -eq OR ==
- Not equal: -ne OR !=
- Greater than, greater than or equal to: -gt OR >, -ge OR >=
- Less than, less than or equal to: -lt OR <, -le OR <=
- Not null (empty string): -n
- Null (empty string) : -z

LOGIC

- Looping – for

```
for var in list
do
    Statement(s)
done
```

- Examples

```
for i in 1 2 3 4 5
```

```
for i in $(seq 1 5)
```

FLOW CONTROL

```
if condition
then
    commands
elif condition
then
    commands
else
    commands
fi
```

```
if name=Michael
    then <run some command>
```

If name doesn't equal Michael...

```
elif name=Mary
    then <run some command>
```

If name doesn't equal Michael OR Mary...

```
else
    then <run some command>
fi
```

BASH if CONDITIONS

Expression	Description
-d file	True if file is a directory
-e file	True if file exists
-f file	True if file exists and is a regular file
-z string	True is string is a null (empty) string
-n string	True if string is not a null (empty string)
stringA = stringB	True if strings are equal
stringA != stringB	True if strings are not equal

BASH SCRIPTING

- test / [ ]

  if test –eq $name “Michael”

  if [$name = “Michael”]

- break
  - Exits the current loop iteration
- exit
  - Exits a script and returns a value (exit code)

BASH PORT SCANNER

portscan.sh

File Edit Search Options Help

```
#!/bin/bash

target=$1
minPort=$2
maxPort=$3

function scanports
{
for ((counter=$minPort; counter<=$maxPort; counter++))
do
        (echo >/dev/tcp/$target/$counter) > /dev/null 2>&1 && echo "$counter open"
done
}

scanports
```

QUICK REVIEW

- Bash is the default shell in Linux
- Bash makes it easy to combine multiple commands that can react to input
- Learn basic loops and conditional logic
- A few lines of a bash script can automatically execute many commands, such as scans

Episode 11.03 Bash Scripting Techniques

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

BASH SCRIPTING I/O

- I/O – File vs. terminal vs. network
  - Input from a terminal

```
read –p “Enter your name:” name ; echo “Hi, “ $name
```

  - Input from a file

```
input=“filePathName”
```

```
while IFS= read –r f1 f2 f3 f4
```

  - Input from the network

```
while read –r inline < /dev/ttyS1
```

ERROR HANDLING

- Error handling
  - “$?” is the exit status of a script we just ran

```
if [ “$?” = “0”] then
```

ARRAYS

```
bashArray = (val1, val2, val3)
```

OR

```
declare –a bashArray = (val, val2, val3)
```

```
for i in 1 2 3
do
    echo ${bashArray[$i]}
done
```

ENCODING/DECODING

- locale – shows local related environment variables
- Can change assignment of LANG for local character encoding
  - Allows bash to accept special charaters (i.e. LANG=da_DK.UTF-8)

ENCODING/DECODING

- Can use openssl or base64 to encode and decode strings (base64)

Encoding:

`echo string | base64` OR `base64 <<< string`

Decoding:

`echo string | base64 --decode` OR `base64 –d <<< string`

BASH: PUTTING IT ALL TOGETHER

- Port scanner in bash

portscan.sh

File Edit Search Options Help

```
#!/bin/bash

target=$1
minPort=$2
maxPort=$3

function scanports
{
for ((counter=$minPort; counter<=$maxPort; counter++))
do
        (echo >/dev/tcp/$target/$counter) > /dev/null 2>&1 && echo "$counter open"
done
}

scanports
```

QUICK REVIEW

- Redirecting input from stdin and output to stdout is the most common bash I/O technique
- Bash scripts can be used with Linux pipes
- Arrays can be useful, but aren't supported in older shells (make sure you're running bash and not sh)

Episode 11.04 PowerShell Scripting Basics

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

COMMENTS

- Helps you remember what you were thinking
  - Single line comments start with the “#” character
  - Multi line comments look like this: <# comment #>

VARIABLES

- Variables
  - Variable names always start with “$” ex. $name = ‘Michael’
    - OR $numberList = 1,3,5,7
  - Write-Host $name $numberList
  - gci variable # lists all defined variables
  - Valid data types: [Array], [Bool], [DateTime], [Int], [Int32], [String] (and more)

SUBSTITUTIONS

- Environment variable – Get-Item Env:varName
  - Reference with $Env:varName
- Input parameters

```
param (
    [string]$server = “10.10.10.0”,
    [Parameter(Mandatory=$true)][string]$username,
    [string]$password = (Read-Host “Input password, please”)
)
```

COMMON OPERATIONS

- String operations – strings are objects
  - Concatenate “Hello” + “ “ + “world”
  - Length (“Hello world”).Length
  - Substring (“Hello world”).Substring(2,5)
  - Replace substring (“Hello world”).Replace(“Hello”,”Greetings”)

COMPARISONS

- if [“$varA” –eq “$varB”]
- Equal: -eq
- Not equal: -ne
- Greater than, greater than or equal to: -gt , -ge
- Less than, less than or equal to: -lt , -le
- Wildcard match: -like
- Match a portion of a string: -match
- Logical operators -and –or –not (or !)

LOGIC

- Looping – For, While, Do-While, Do-Until

```
For ($i=0; $i -lt $colors.Length; $i++) { cmds }
```

```
Foreach ($i in $range) { cmds }
```

```
While ($true) { cmds }
```

```
Do { cmds } While ($i –le 10)
```

```
Do { cmds } Until ($i –gt 10)
```

LOGIC

- Flow control

```
if (condition) {
    statements
} elseif (condition) {
    statements
} else {
    statements
}
```

I/O

- File vs. terminal vs. network
  - Input from a terminal

```
$firstName = Read-Host –Prompt ‘Enter first name’
Write-Host $firstName
```

  - Input from a file

```
$lines = Get-Content filename
Out-File –FilePath filename –InputObject $lines –Encoding ASCII
```

  - Input from the network

```
$socket = new-object System.Net.Sockets.TcpClient($ip, $port)
If($socket.Connected) { }
```

ERROR HANDLING

- Try/catch

```
try {
    Command
}
catch {
    errorHandling commands
}
```

ARRAYS

```
$PSarray=@(1.3.5.7.9);
$PSarray.Length
for ($i = 0; $i –lt $PSarray.Length; $i++) {
    $PSarray[$i]
}
foreach ($element in $PSarray) {
        $element
}
```

POWERSHELL SCRIPTING

- Encoding/decoding

```
$OutputEncoding = [System.Text.Encoding]::Unicode
```

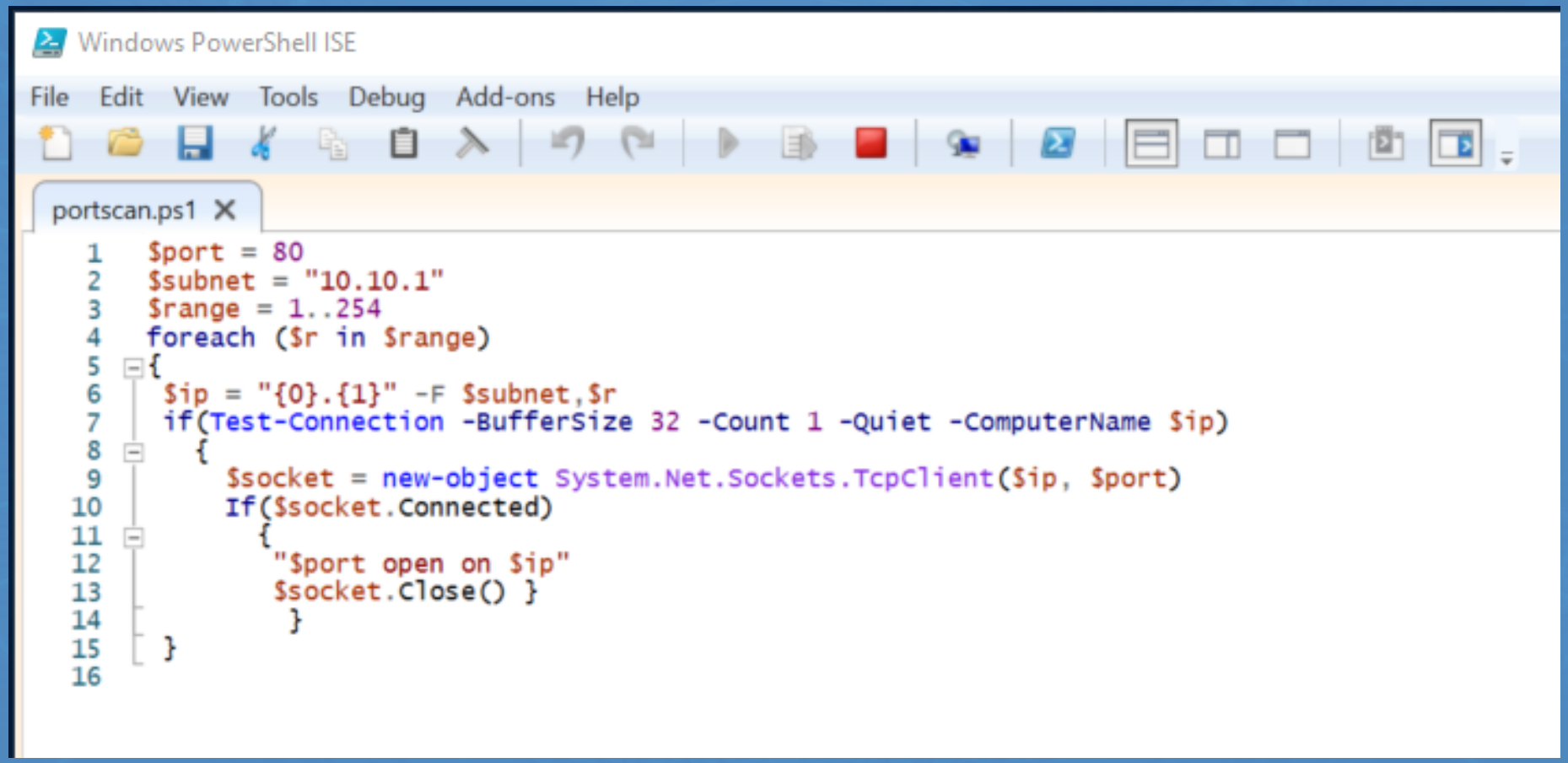
- Base64 encoding

```
$Text = ‘Hello world’
$Bytes = [System.Text.Encoding]::Unicode.GetByteps($Text)
$EncodedText = [Convert]::ToBase64String.($Bytes
```

- Base64 decoding

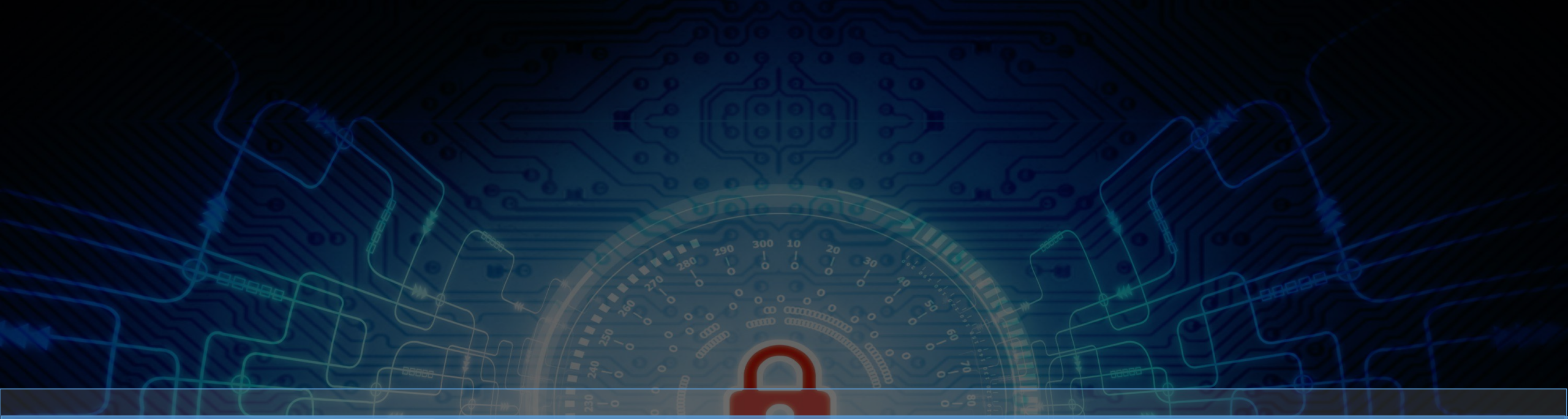
```
$EncodedText = ‘encodedString’
$DecodedText =
[System.Tet.Encoding]::Unicode.GetString([System.Convert]::FromBase
64String($EncodedText)
```

PowerShell: Putting it all together



QUICK REVIEW

- PowerShell is currently open source and available for multiple operating systems
- PowerShell scripts are disabled in Windows by default



Episode 11.05 Ruby Scripts

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

HOW TO RUN RUBY SCRIPTING

- Download and install Ruby
  - https://www.ruby-lang.org/en/downloads/
  - Launch Ruby: irb (Interactive Ruby) (ctrl-D to exit)
  - Or, just run Ruby from a web browser - https://ruby.github.io/TryRuby/
- Comments
  - '#' for single line comments, =begin comments =end (multi-line comments)
- Variables
  - name = "Michael"
  - number = 22
  - puts name, number
  - Valid data types: number, string, Boolean, symbol, array, hash

SUBSTITUTIONS

- Environment variables `puts ENV['PATH']`
- Input parameters `ARG[0] ARG[1]`

```
ARGV.each do |a|
    puts "Argument: #{a}"
end
```

  - Ruby also has an OptionParser library
- Values from other utilities `` `echo $PATH` ``

COMMON OPERATIONS

- String operations
  - Concatenation “snow” + “ball”
  - Repetition “hi” * 3
  - Length “hello”.length
  - Substring (extract or replace) “hello”[1..3]

COMMON OPERATIONS

- Comparisons
  - Equal ==
  - Not equal !=
  - Greater than, greater than or equal to >, >=
  - Less than, less than or equal to <, <=
- Logical operations
  - and &&
  - or ||
  - not !

LOGIC

- Looping – while, until, for

```
while condition do
    statements
end
```

```
until condition do
    statements
end
```

```
for var in expression do
    statements
end
```

LOGIC

- Flow control

```
if condition then
    statements
elsif
    statements
else
    statements
end
```

LOGIC

```
Case input
    when “A”
            statement
    when “B”
            statement
    else
            statement
end
```

I/O

- File vs. terminal vs. network
  - Input from terminal
  - Input from a file
  - Output to a file
  - Network I/O

```
name = gets
```

```
inFile = File.new("filename","r")
inFile.each_line {|line| puts "#{line.dump}" }
inFile.close
```

```
$stdout << 76 << " trombones" << "\n"
```

```
client = TCPSocket.open('hostname', 'port')
client.send("string",0)
```

ERROR HANDLING

- begin / end / rescue

```
begin
    statements
rescue
    statements if error occurred
else
    statements if no error
end
```

ARRAYS

```
rubyArray = [ “val1”, “val2”, “val3” ]
print rubyArray[1]
print rubyArray.index(“val2”)
print rubyArray.last OR print rubArray[-1]
```

ENCODING/DECODING

```
Require “base64”
encString = Base64.encode64(‘Hello world!”)
plaintext = Base64.decode(enc)
```

RUBY: PUTTING IT ALL TOGETHER

portscan.rb

File Edit Search Options Help

```
#!/usr/bin/ruby

require 'socket'

TARGET = ARGV[0] || '10.10.1.10'
MINPORT = ARGV[1] || 22
MAXPORT = ARGV[2] || 80

$i = MINPORT.to_i
while $i <= MAXPORT.to_i do
  begin
    socket = TCPSocket.new(TARGET, $i)
    status = "open"
    puts "Port #{$i} is #{status}."
  rescue Errno::ECONNREFUSED, Errno::ETIMEDOUT
    status = "closed"
  end
  $i = $i + 1
end
```

QUICK REVIEW

- Ruby is a powerful object-oriented language that can do far more than just scripting
- Ruby's popularity is related to the Ruby on Rails server-side web application framework written in Ruby
- Ruby treats everything as an object and relies heavily on methods and attributes

Episode 11.06 Python Scripts

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

PYTHON SCRIPTING

- Download and install Python
  - https://wiki.python.org/moin/BeginnersGuide/Download
  - Two versions in use: 2 and 3
  - Launch Python: python (ctrl-D to exit)
- Comments - all comments start with “#”
- Variables
  - name = “Michael”
  - number = 22
  - print(name + “ “ + str(number))
  - Valid datatypes: numbers, string, list, tuple, dictionary

SUBSTITUTIONS

- Input arguments (parameters)

```
import sys
print (“Name of script:”, sys,argv[0])
print (“Number of arguments: “, len(sys.argv))
print (“Arguments: “, str(sys.argv))
```

- Environment variables

```
import os
extPath = os.environ[‘PATH’]
```

COMMON OPERATIONS

- String operations
  - Concatenate — string1 + string 2
  - Length — len(string)
  - Extract substring — string[start:end+1]
  - Replace a substring — string.replace(old, new, count)

COMMON OPERATIONS

- Comparisons
  - Equal ==
  - Not equal != OR <>
  - Greater than, greater than or equal to >, >=
  - Less than, less than or equal to <, <=
- Logical operations
  - and
  - or
  - not

LOGIC

- Looping – for, while

```
for i in range(1, 10):
    print(i)
```

```
while x < 10:
    print (x)
    x += 1
```

LOGIC

- Flow control – if

```
If var == value:
        statements
elif var > value:
        statements
else:
        statements
```

- Notice indentation

I/O

- File vs. terminal vs. network
  - Input from a terminal
    - name = raw_input('Please enter your name') # map to simple datatype
    - toppings = input('Which toppings do you want on your pizza?') # maps to complex datatype
    - Input() will store data in the "best" datatype (i.e. list, etc.)

I/O

- Input from a file

```
f = open('inFile.txt','r')
for line in f:
        do something here
f.close()
```

I/O

- Output to a file

```
f = open('outFile.txt','w')
for i in range(1,11):
        print >> f, I
f.close()
```

I/O

- Input from a network

```
sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
If sock.connect_ex((remoteServerIP, port)) == 0:
    print ('Port {}: is Open'.format(port)
```

ERROR HANDLING

- Try / except / finally blocks

```
try:
    statements
    raise customErrorObject
except errorObject:
    statements
except customErrorObject:
    statements
finally:
    statements to clean up
```

ARRAYS

```
pythonArray = [10, 20, 30, 40, 50]
Print(pythonArray[1])       # -1 is last element index
len(pythonArray)
pythonArray.append(60)  # add 60 to the array
pythonArray.remove(30)  # remove element 30
pythonArray.pop(3)          # remove the 4th current element
```

ENCODING/DECODING

```
Import base64
encString = base64.encodestring('Hello world!')
plaintext = base64.decodestring(encString)
```

Python: Putting it all together

portscan.py

File Edit Search Options Help

```
1  import sys, socket
2
3  target = sys.argv[1]
4  minport = int(sys.argv[2])
5  maxport = int(sys.argv[3])
6
7  def porttry(cur_target, port):
8      try:
9          s.connect((cur_target, port))
10         return True
11     except:
12         return None
13
14
15 for i in range(minport, maxport+1):
16     s = socket.socket(2, 1) #socket.AF_INET, socket.SOCK_STREAM
17     value = porttry(target, i)
18     if value != None:
19         print("Port opened on %d" % i)
20
```

QUICK REVIEW

- Python is another powerful object-oriented language
- Python is a popular language because it’s easy to write very powerful programs in just a few lines of code
- Unlike many other languages, Python depends on indentation to define blocks

Episode 11.07 Scripting Languages Comparison

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
Comments	#	# or <# #>	# or =begin =end	#
Variables – assign	varName=value	$varName=value	varName=value	varName=value
Variables – display	echo $varName	Write-Host $varName	puts varName	print(varName)
Substitution – environment variables	$envVarName	Get-item Env:varName	ENV[‘varName’]	Os.environ[‘varName’]

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
String length	${#string}	(string).Length	string.length	len(string)
String – substring	${string:position}	(string).Substring(start,end)	string[1..3]	string[start:end+1]
String – replace substring	${string/substring/replacement}	(string).Replace(substr,replStr)	string[1..3] = replStr	string.replace(old, new, count)
AND/OR	-a / -o	-and, -or, -not !	and &&, or ||, not !	and, or, not
Comparisons	-eq (==), -ne (!=), -lt (<), -le (<=), -gt (>), -ge (>=)	-eq, -ne, -gt, -ge, -lt, -le	==, !=, >, >=, <, <=	==, != (<>), >, >=, <, <=

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
Looping	For	For, While, Do-While, Do-Until	while, until, for	for, while

Flow control	if condition
	then
	  commands
	elif
	  commands
	else
	  commands
	fi
		if (condition) {
		  statements
		} elseif (condition) {
		  statements
		} else {
		  statements
		}
			If condition then
			  statements
			elsif
			  statements
			else
			  statements
			end
				if condition:
				  statements
				elif condition:
				  statements
				else:
				  statemenst

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
Input – file	Input="filename" While IFS=read –r f1 f2 f3	$lines = Get-Content filename Out-File –FilePath filename –InputObject $lines –Encoding ASCII	inFile = File.new("filename","r") inFile.each_line {|line| puts "#{line.dump}" } inFile.close	f = open('inFile.txt','r') for line in f: do something here f.close()
Input – terminal	Read –p "Prompt:" var	$firstName = Read-Host –Prompt 'Enter first name'	name = gets	name = raw_input('Please enter your name')

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
Input – network	While read –r inline < /dev/ttyS1	$socket = new-object System.Net.Sockets.TcpClient($ip, $port) if($socket.Connected) { }	client = TCPSocket.open(‘hostname’, ‘port’) Client.send(“string”,0)	sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM) If sock.connect_ex((remoteServerIP, port)) == 0: print (‘Port {}: is Open’.format(port)

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python

Error handling	If [“$?” = “0”] then	try {
		Command
		}
		catch {
		errHandling commands
		}
			begin
			statements
			rescue
			statements if error occurred
			else
			statements if no error
			end
				try:
				statements
				raise customErrorObject
				except errorObject:
				statements
				except customErrorObject:
				statements
				finally:
				statements to clean up

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python

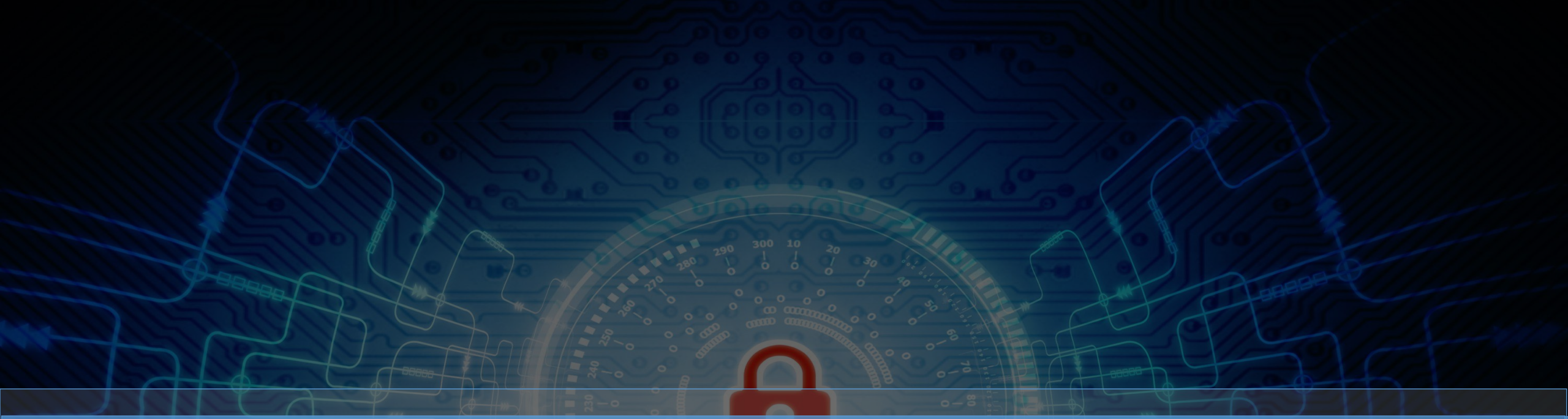
Arrays	bashArray = (val1, val2, val3)
	For I in 1 2 3
	Do
	  echo ${bashArray[$i]}
	done
		$PSarray=@(1.3.5.7.9);
		for ($i = 0; $i –lt $PSarray.Length; $i++)
		{
		$PSarray[$i]
		}
		foreach ($element in $PSarray) {
		  $element
		}
			rubyArray = [“val1”, “val2”, “val3”]
			print rubyArray[1]
			print rubyArray.index(“val2”)
			
				pythonArray = [10, 20, 30, 40, 50]
				Print(pythonArray[1])
				len(pythonArray)

Comparing Scripting Languages

	Bash	PowerShell	Ruby	Python
Encoding	Echo plainText | base64	$Text = 'Hello world' $Bytes = [System.Text.Encoding]::Unicode.GetByteps($Text) $EncodedText = [Convert]::ToBase64String.($Bytes	Require "base64" encString = Base64.encode64('Hello world!")	Import base64 encString = base64.encodestring('Hello world!')
Decoding	Echo encString | base64 --decode	$EncodedText = 'encodedString' $DecodedText = [System.Tet.Encoding]::Unicode.GetString([System.Convert]::FromBase64String($EncodedText)	plaintext = Base64.decode(enc)	plaintext = base64.decodestring(encString)

QUICK REVIEW

- Recognize unique Bash script syntax - output (echo), error-handling ("$?")
- Recognize unique PowerShell script syntax - output (Write-Host), flow-control (elseif), error-handling (try/catch)
- Recognize unique Ruby syntax - output (puts), flow-control (elsif), error-handling (rescue)
- Recognize unique Python syntax - output (print), error-handling (try/except/finally)



Episode 11.08 – Data Structures, Part 1

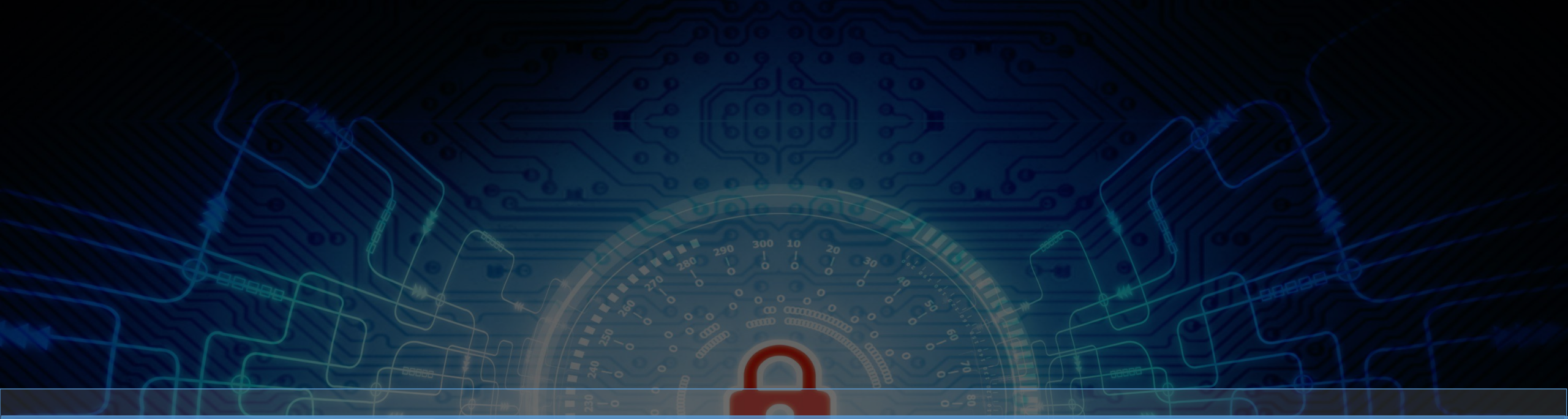
Objective 5.1 Explain the basic concepts of scripting and software development

Data Structures

- JavaScript Object Notation (JSON)
  - Show JSON example(s) in code and use
  - Explain why JSON is popular
- Key value
  - Python example
- Dictionaries
  - Python example

QUICK REVIEW

- JSON is a popular format for programs to exchange data
- JSON is readable by humans and easy to use for many languages
- Key-value pairs are easy ways to label data fields
- Dictionaries provide a way to store collections of key-value pairs



Episode 11.09 – Data Structures, Part 2

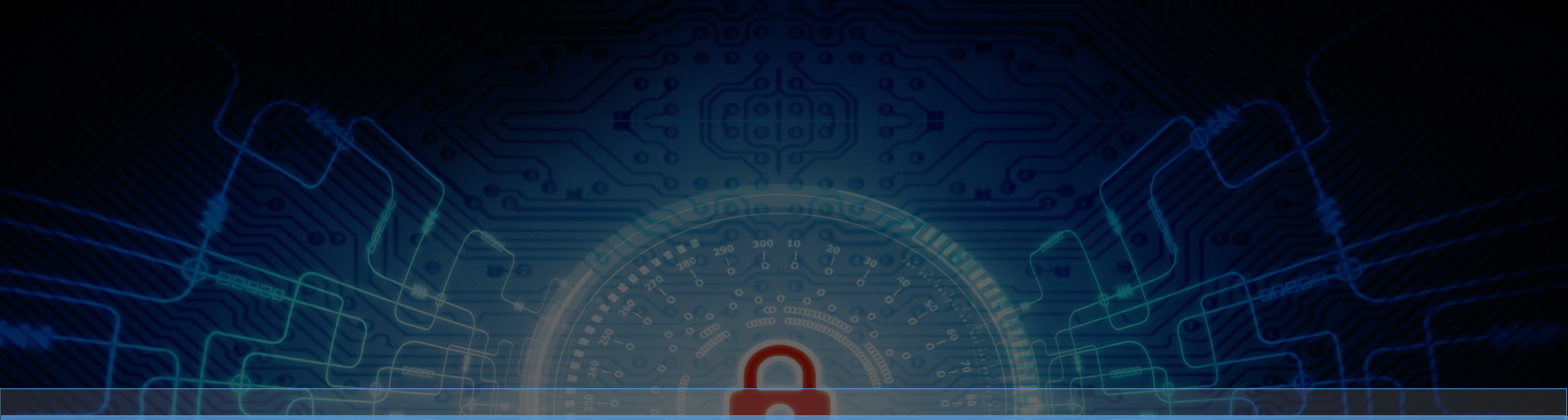
Objective 5.1 Explain the basic concepts of scripting and software development

Data Structures

- Comma-separated values (CSV)
  - Show example
  - Explain why csv is popular
- Lists
  - Explain/describe
- Trees
  - Explain types of trees and their uses

QUICK REVIEW

- CSV is a simple way to store data in files that many programs can read
- Individual data fields in a CSV are separated by commas
- A list is a convenient way to store multiple data values
- Trees are more complex data structures that support fast searching



Episode 11.10 –Libraries

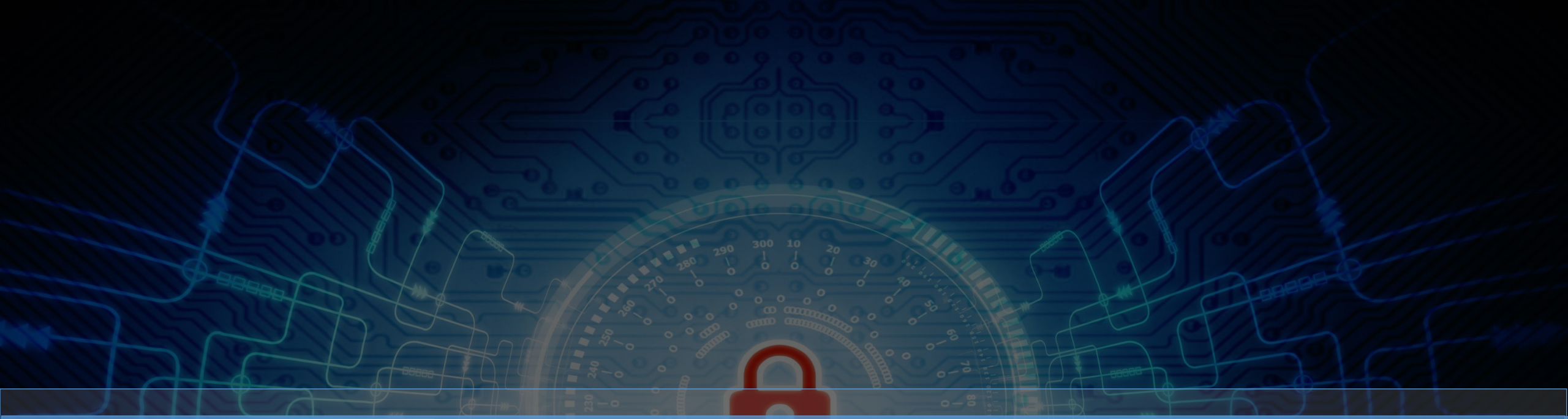
Objective 5.1 Explain the basic concepts of scripting and software development

Libraries

- Libraries provide ready-made functionality
- Show Python example(s)
- Note the reliance on other developers for quality and security

QUICK REVIEW

- Libraries are collections of external code that are included in a program
- Libraries make it easy to draw on a large volume of code someone else wrote
- If a library contains vulnerabilities, any code that includes it will contain them, too



Episode 11.11 –Classes

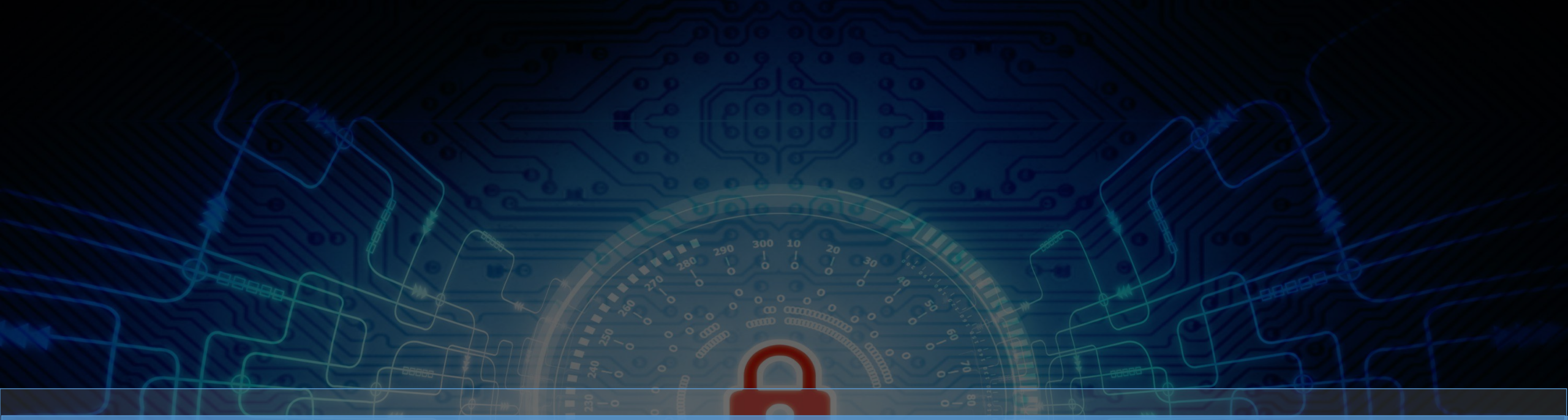
Objective 5.1 Explain the basic concepts of scripting and software development

Classes

- Describe basic OO concepts
- Explain the value of classes
- Show Python class example

QUICK REVIEW

- A class is a blueprint, or template, that contains definitions used to create objects
- An object is an instance of a class that includes state data and functionality
- Each instance of an object is a unique entity
- Object Oriented (OO) programming supports a modular approach to handling data and functionality



Episode 11.12 –Procedures and Functions

Objective 5.1 Explain the basic concepts of scripting and software development

Procedures

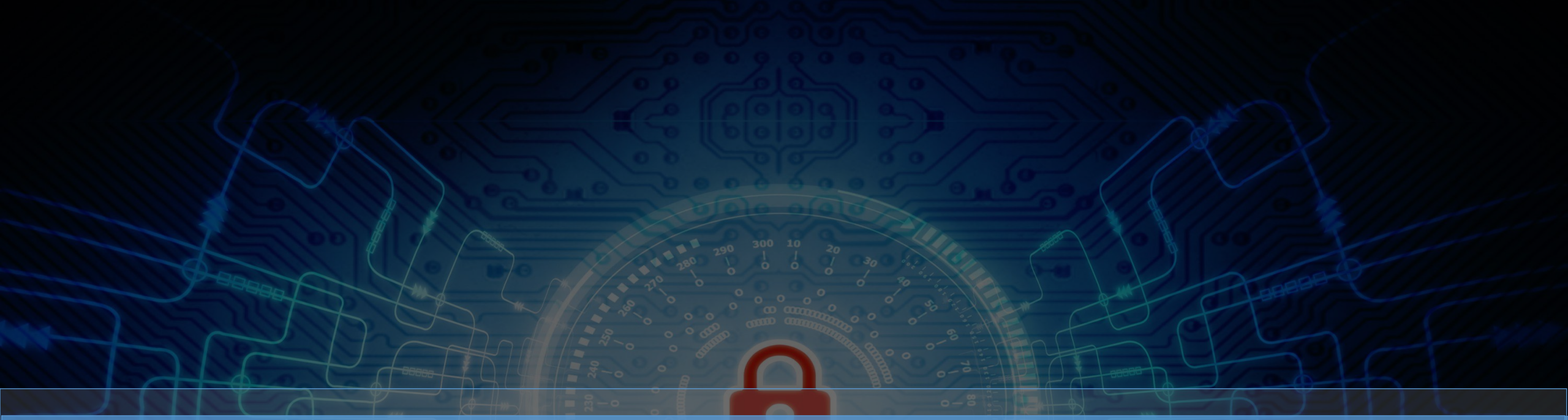
- Define procedures
- Explain the difference between procedures and classes
- Show Python example

Functions

- Describe functions
- Explain the difference between functions and procedures
- Show Python examples

QUICK REVIEW

- Functions and procedures allow programmers to separate frequently used code and call it as needed
- Procedures only execute statements – no return value
- Functions execute statements and return a value to the caller



Episode 11.13 –Perl and JavaScript (Name TBA?)

Objective 5.2 Given a scenario, analyze a script or code sample for use in a penetration test

Perl

- Perl – Flexible general purpose scripting language
  - Actually, a family of 2 languages
    - Perl 5, just called Perl, and Pearl 6, now called Raku
  - Originally developed as a UNIX scripting language for report processing
  - Perl and Raku now run on most operating systems

Javascript

- JavaScript – High level, just in time compiled language
  - Popular in web applications
  - Flexible and powerful standalone language
    - Node.js – Popular open source JavaScript runtime environment

Additional Resources

- Perl
  - https://www.perl.org/
  - https://resources.infosecinstitute.com/topic/penetration-testing-of-web-services-with-cgi-support/
  - https://github.com/lucthienphong1120/pentesting-scripts
  - https://highon.coffee/blog/penetration-testing-tools-cheat-sheet/
- JavaScript
  - https://www.javascript.com/
  - https://github.com/cybersecurity-acmgmrit/Javascript-Pentesting
  - https://sp1icer.dev/writeups/javascript-for-pentesters-intro/
  - https://resources.infosecinstitute.com/topic/penetration-testing-node-js-applications-part-1/

Perl

```
#!/usr/bin/perl
use IO::Socket;
$| = 1;
print "IP : "; chop ($ip = <stdin>);
print "Start: "; chop ($startPort = <stdin>); print "End: "; chop ($endPort = <stdin>);

foreach ($port = $startPort ; $port <= $endPort ; $port++) {
    $socket = IO::Socket::INET->new(PeerAddr => $ip, PeerPort => $port, Proto => 'tcp',
Timeout => 1);
    if( $socket ) {
        print "\r = Port $port is open.\n" ;
    }
    else { #Port is closed, silently move on }
}
exit (0);
```

Javascript

```
var portscanner = require('portscanner');

// 127.0.0.1 is the default hostname
portscanner.findAPortNotInUse([3000, 3010],
'127.0.0.1').then(port => {
  console.log(`Port ${port} is available!`);
});
```

QUICK REVIEW

- Perl is a flexible general purpose scripting language commonly used by system administrators
- JavaScript is another open-source flexible scripting language and is the core technology of the World Wide Web