BEAM Virtual Machine shenanigans

TLP:CLEAR

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Preleminaries

- Erlang/Elixir source code is compiled into `.beam` bycode
- BEAM is the virtual machine that runs this bycode
- The BEAM runs as a system process, and holds Erlang processes
- Processes inside the BEAM VM exchanges messages through mail boxes
- The Open Telecom Platform contains:
  - the BEAM,
  - the erlang compiler,
  - behaviours and applications for developing horizontally scalable systems process groups

Preleminaries

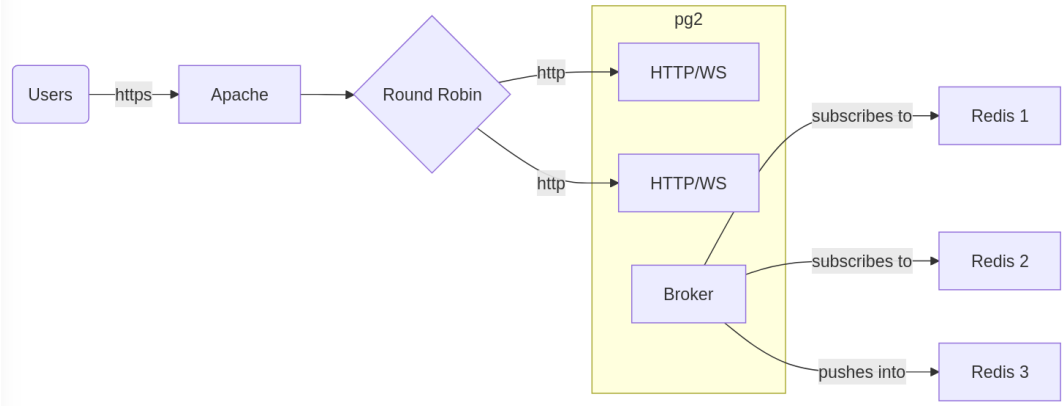


Figure 1: use of pg2 in cocktailparty

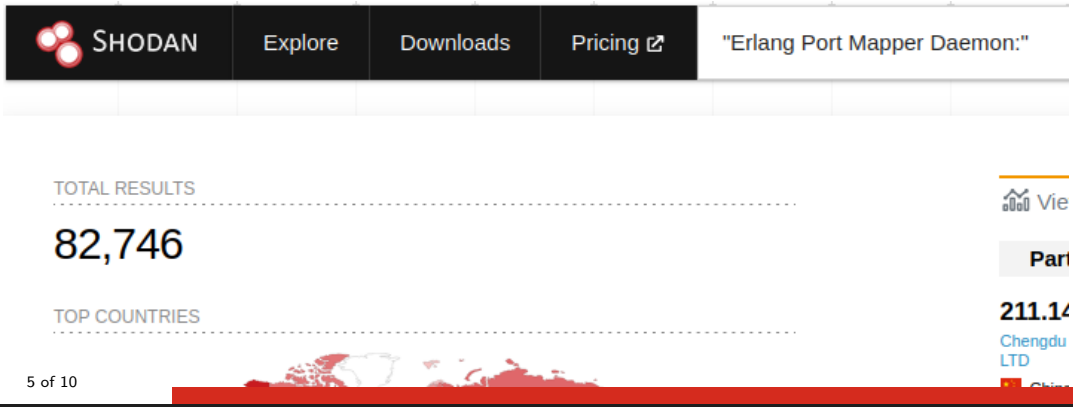
Distributed Erlang

- Erlang runtimes (nodes) communicating with each other
- Protected with a PSK: the `cookie`
- Erlang Port Mapper Daemon maps nodes names to system's port

```
$ echo -n -e "\x00\x01\x6e" | nc -vn 10.56.244.246 4369
Connection to 10.56.244.246 4369 port [tcp/*] succeeded!
name erlol at port 44101
```

Distributed Erlang

- EPMD should not be exposed to the internet
- node communications should never occur over untrusted networks



Eshell

- Connects your local node to a remote elixir or erlang REPL running on BEAM
- Very bad logging by default
- can compile from String
  - `[{module, binary}] = Code.compile_string("defmodule CompTest do def print(x) do IO.puts(x) end end")`
- can replace an existing module
- without the source: get the AST, modify the AST, recompile (left as an exercise :-)

Eshell

- can deploy on all cluster's nodes.
  - erlang `nl(module)`
  - elixir
    - `Enum.each(Node.list(), fn node -> :rpc.call(node, :code, :load_binary, [module, 'nofile', binary]) end)`
    - `Enum.each(Node.list(), fn node -> :rpc.call(node, CompTest, :print, ["Hello from #{node}!"]) end )`

Deploy new modules

- reverse shell on the host
- ssh server for encrypted communication
- ssh client for pivoting and scanning
- defensive module
- special sauce :-)

Conclusion

- Look into the https://erlef.org/wg/security before deploying
- Think twice before connecting to untrusted nodes

Credits and References

- https://github.com/flowintel/cocktailparty
- https://www.erlang.org/docs/18/man/pg2.html
- https://book.hacktricks.xyz/network-services-pentesting/4369-pentesting-erlang-port-mapper-daemon-epmd
- https://github.com/gteissier/erl-matter
- https://www.broot.ca/erlang-remsh-is-dangerous.html