

Scripting and Configuration of MOOS Applications Using Lua

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MIT Laboratory for Autonomous
Marine Sensing Systems
Presented at MOOS-DAWG July 19th, 2011



Since 2007



**First up:
A brief preface**

Happy Anniversary!

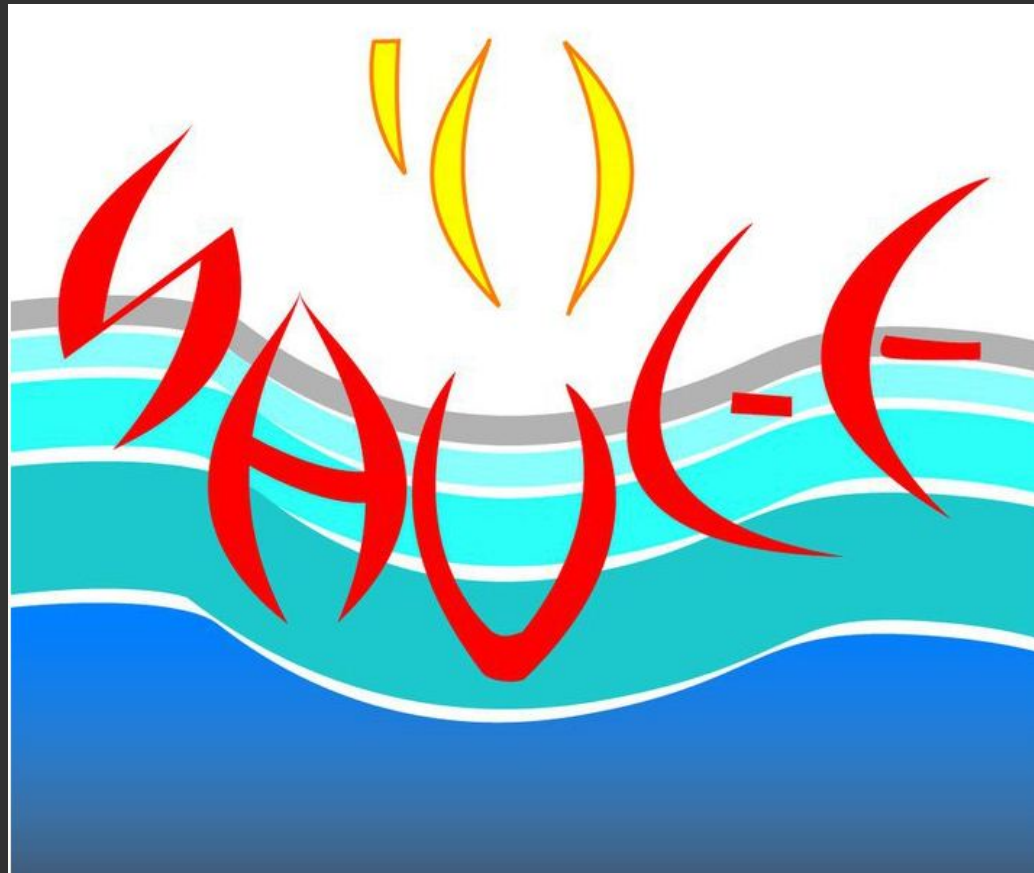
2001-2011

10 years of MOOS



**10 years later:
Is the community still
growing?**

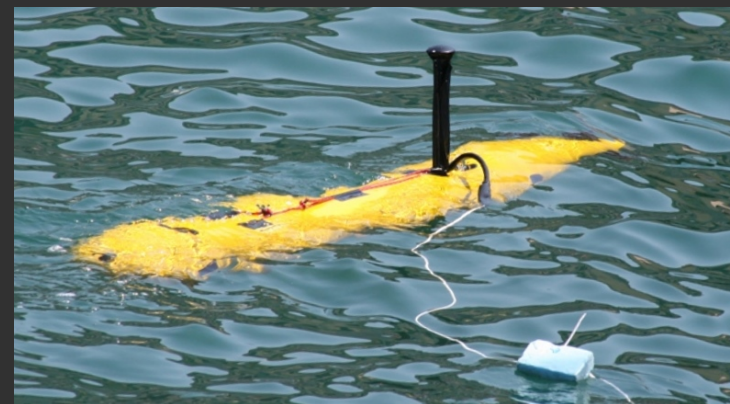
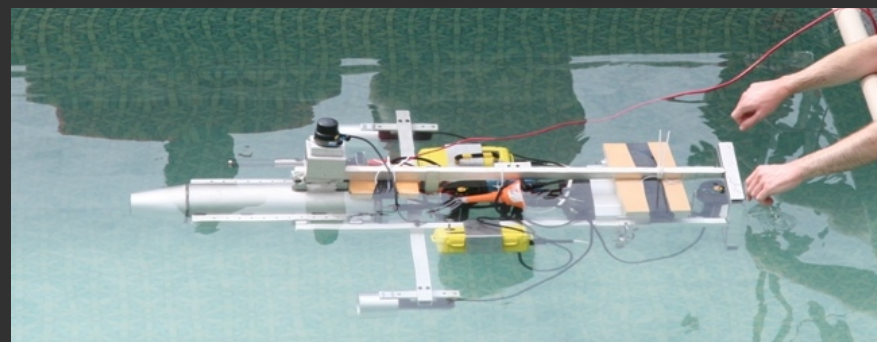
Student Autonomous Underwater Challenge – Europe



July 4th-10th 2011



10 Teams of Students



SAUC-E Software

- OceanShell
- 3 × ROS
- CubeOS/RobLib
- From-scratch C++
- From-scratch C++/java/python
- ...

SAUC-E Software

- OceanShell



- **3 × ROS**

- CubeOS/RobLib



- **From-scratch C++**

- From-scratch C++/java/python

- ...

Today's Topic:

**How I Made MOOS Work
For Me**

Today's Topic:

~~**How I Made MOOS Work
For Me**~~

Today's Topic:

**How We Can Make MOOS
Work Better For
Everyone**

Goals:

- I. **Make MOOS more user-friendly**
- II. **Make better use of developers' time**

Making It Happen

Part 1: Scripting

Part 2: Configuration

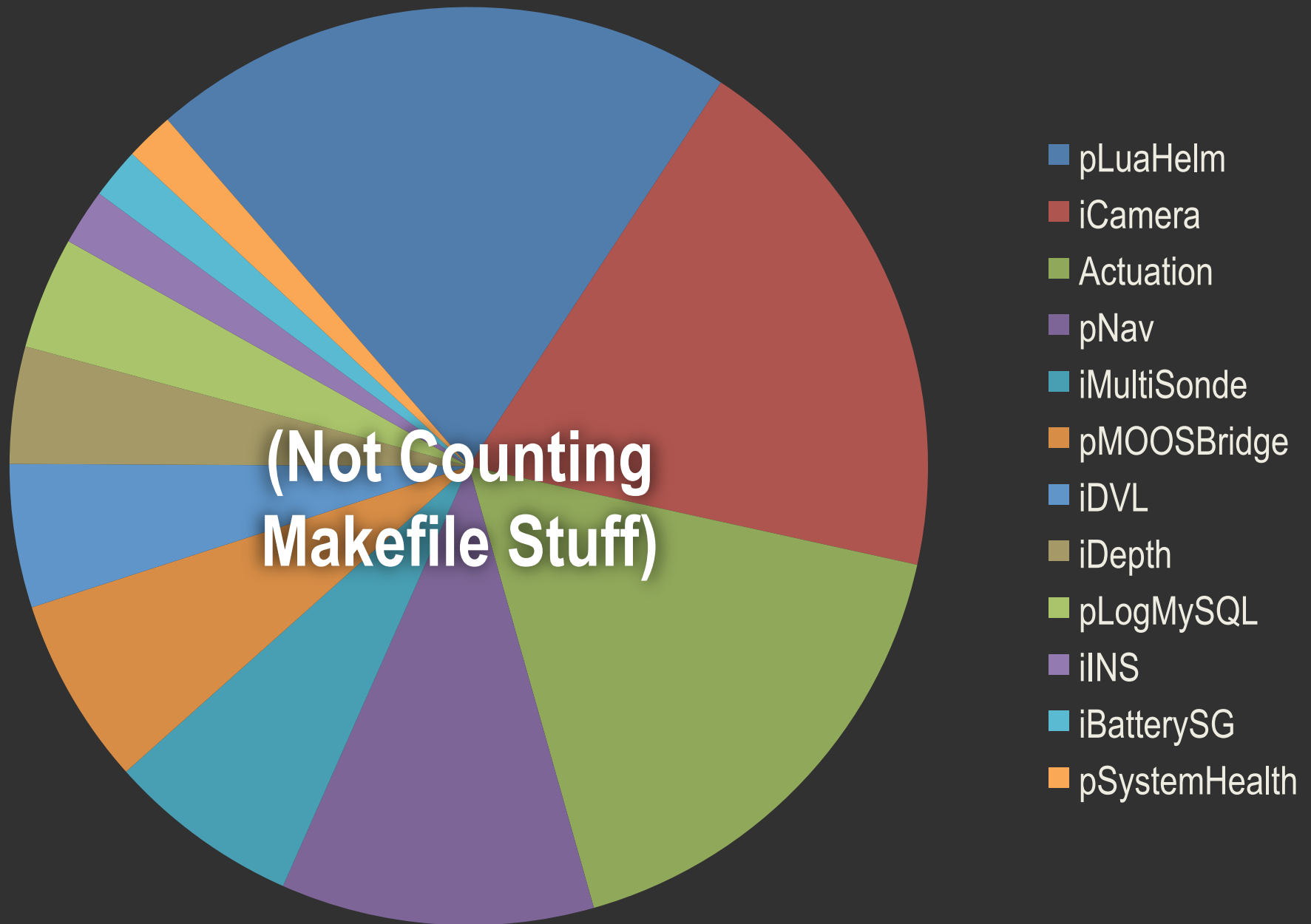
Part 1 of 2

Scripting MOOS
(i.e. Rapid Prototyping)

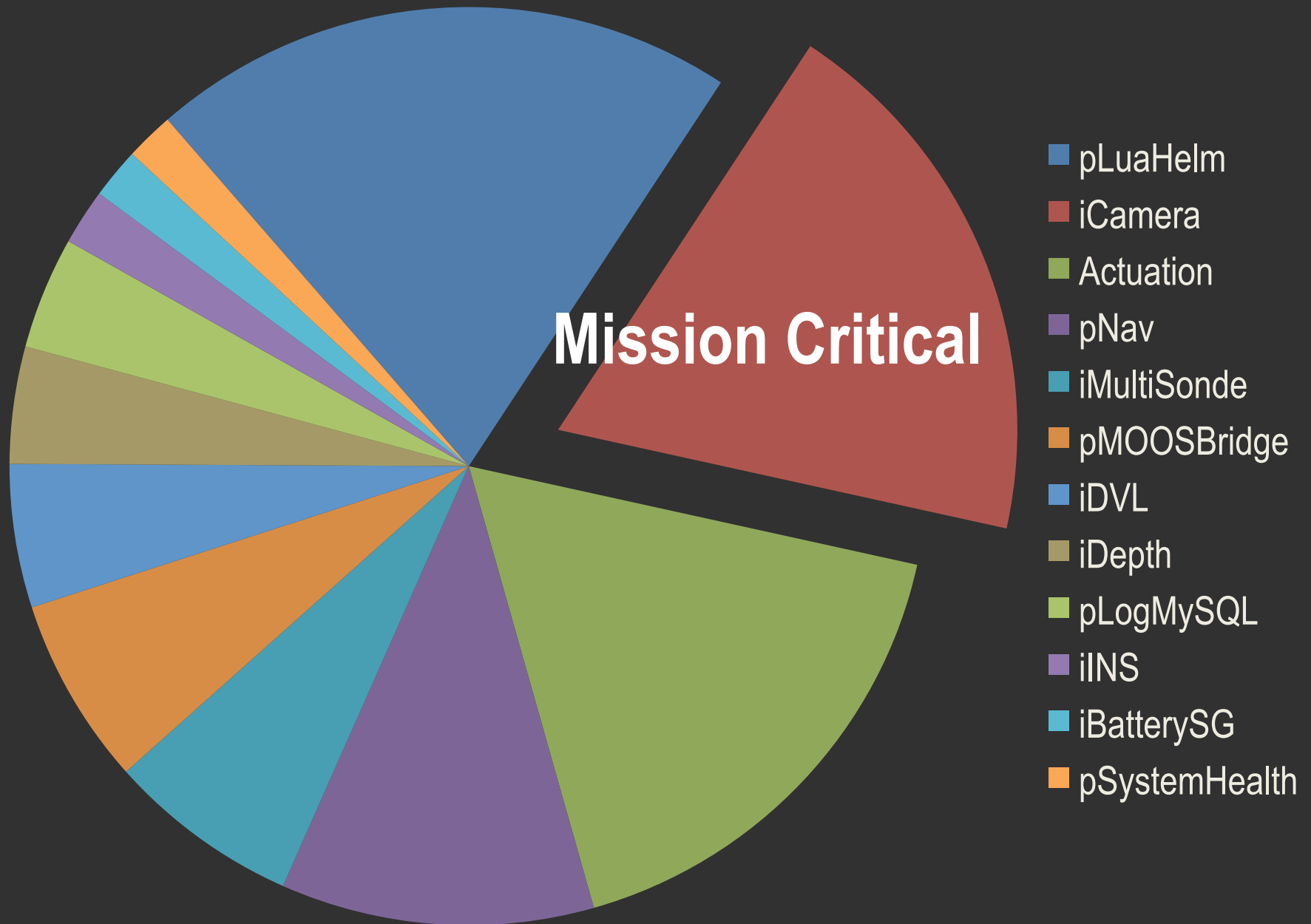
This Isn't For You If ...

- You've never written new code on a boat
- You've never re-written old code on a boat

Lines of C++ in MOOS on Odyssey IV



Lines of C++ in MOOS on Odyssey IV



Make It Simpler: Rapid Development

- Cut the code lines you write in **half**
- Stop writing CMake build files
- No cross-compiling for embedded systems
- Spend less time writing the small utilities

Make It Simpler

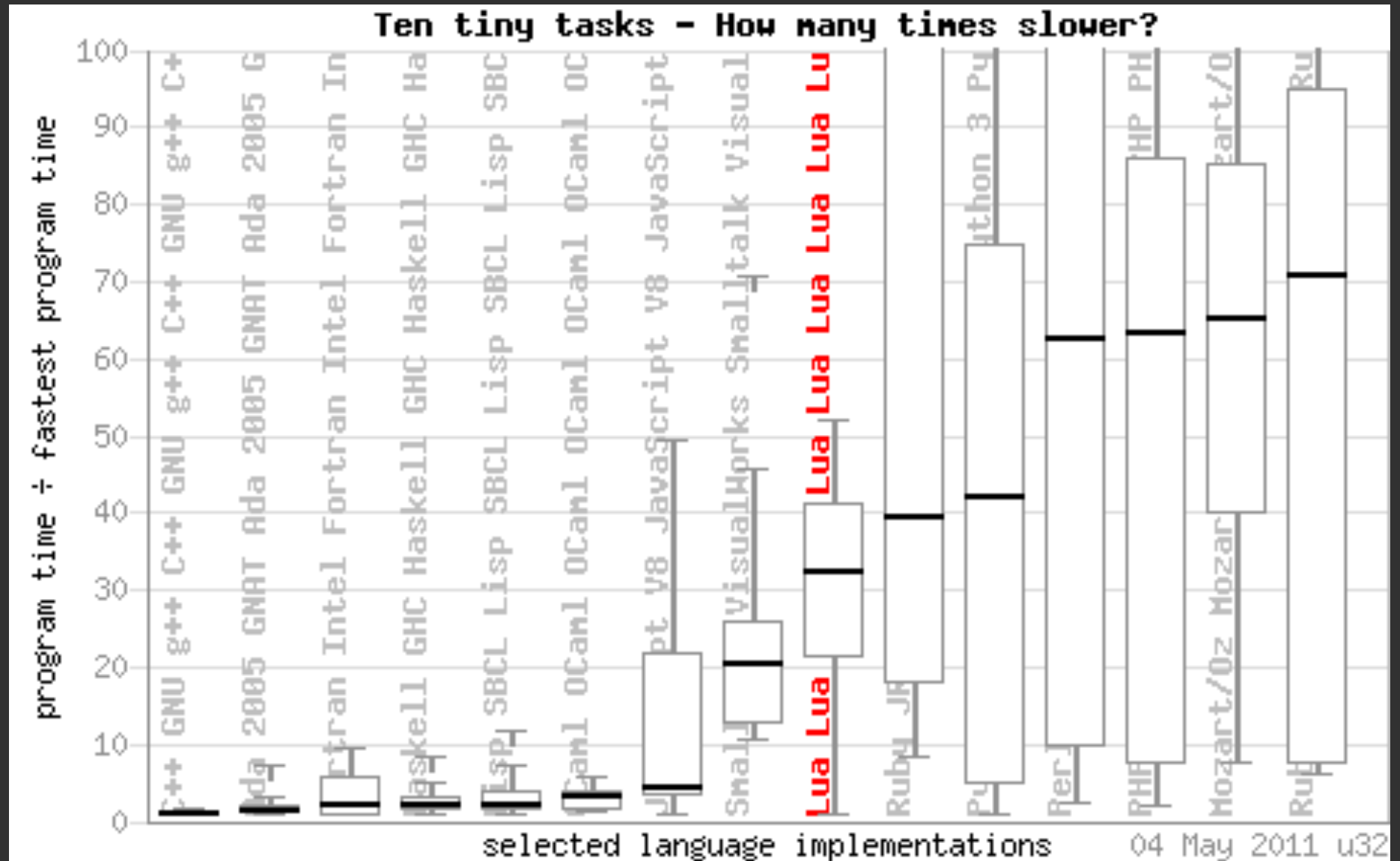
**Spend more time doing actual
research.**

the programming language

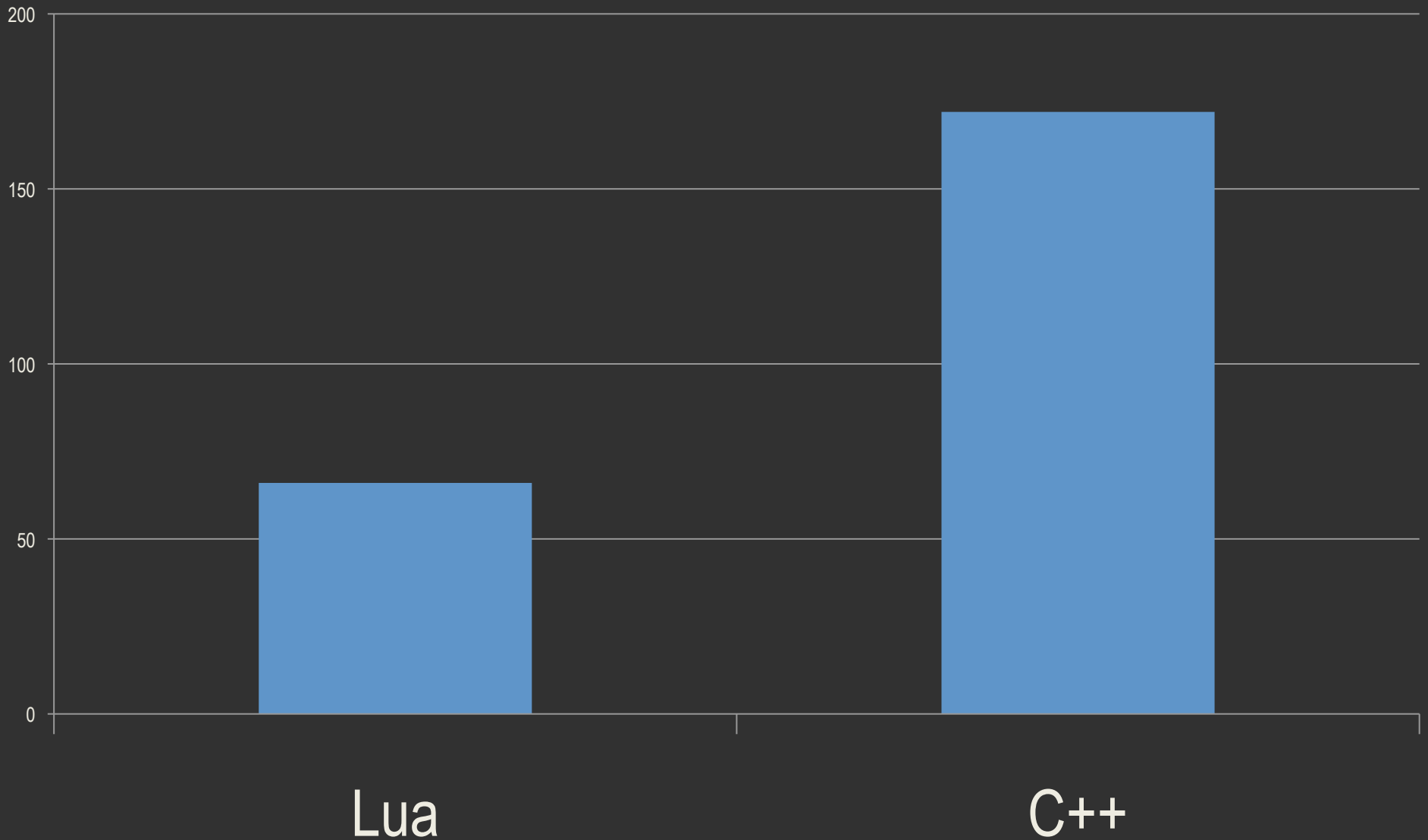
Lua



Lua is a fast scripting language



Lines of Code to Implement pSystemHealth



How It Works

C++ Environment

- MOOSTrace()
- GetConfiguration()
- Notify()

- Iterate()

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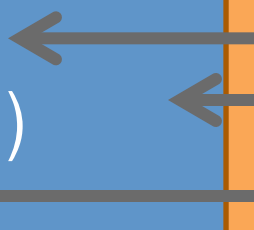
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Lua File

- Tick()



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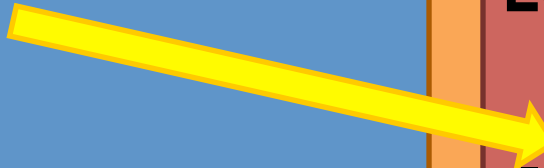
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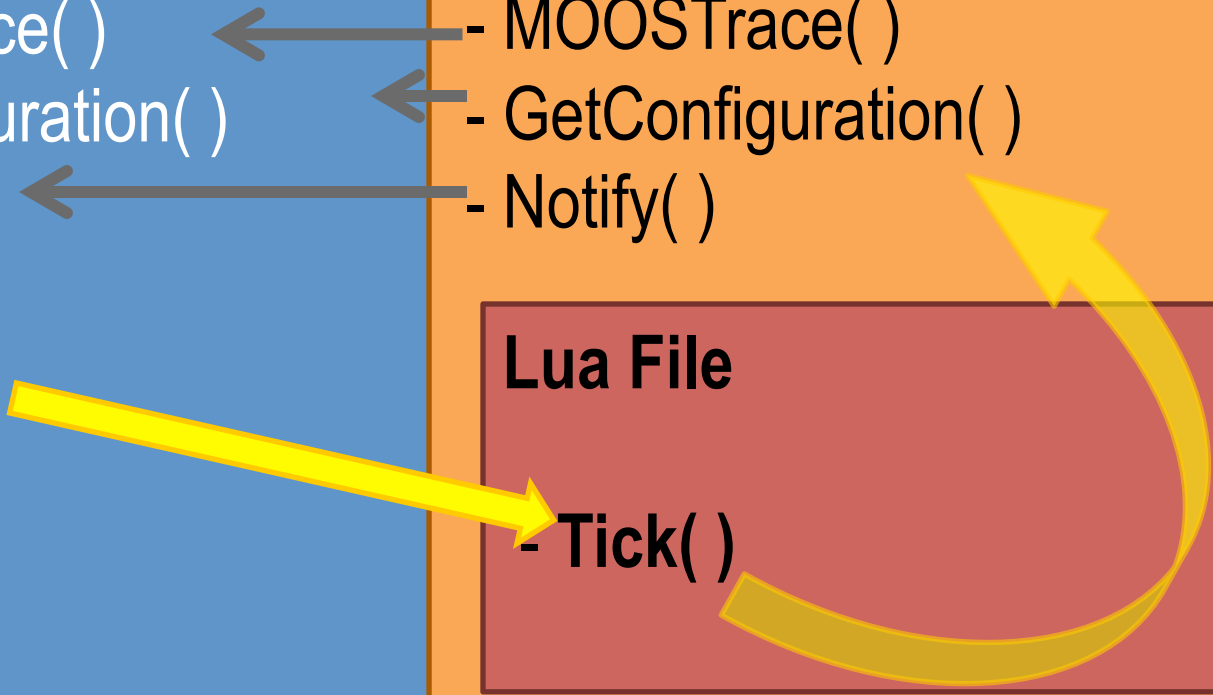
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Example Lua Script: Reading mail

```
-- "vars" is a list of any MOOS messages received since  
-- it can be accessed as a 2-dimensional table: ordinal_  
function Tick(vars)  
    -- this line sorts the messages in vars by name and d  
  
    HAPI_Trace("We just received ", #vars, "messages")  
  
    -- apply Lua's syntactic sugar to the msg list  
    local mail = SimplifyMail(vars)  
  
    -- if mail.DB_TIME exists, take the latest message  
    if mail.DB_TIME then  
        HAPI_Trace("DB Time is", mail.DB_TIME.now)  
    end
```

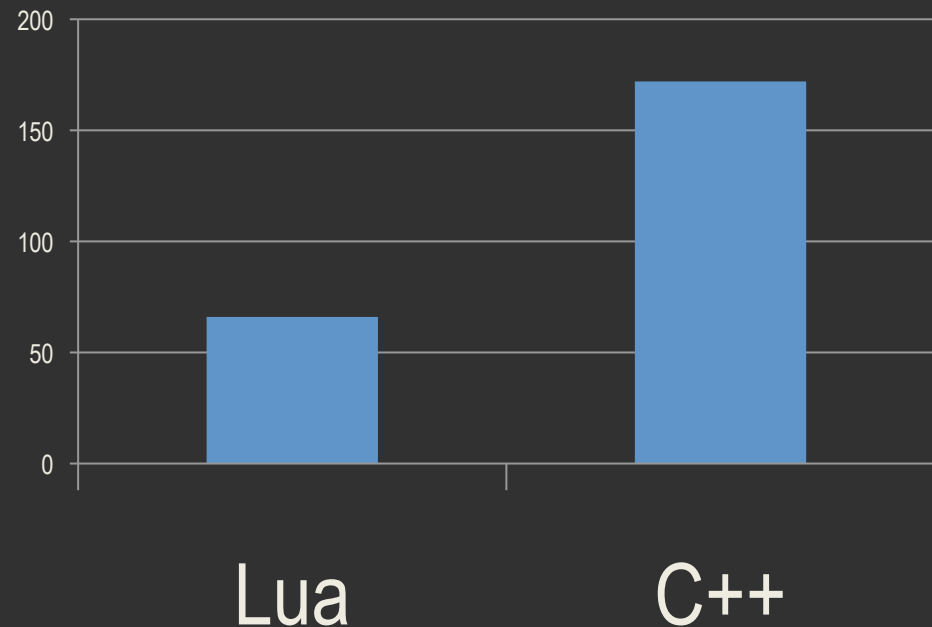
Example Lua Script: Posting messages

```
--read date from shell
local fh = io.popen('date')
local datestring = fh:read("*a")
fh:close()

fh = io.popen("date +%s")
local datenumber = tonumber(fh:read("*a"))
fh:close()

--post values
HAPI_PostString("DUMmyscript_DATESTRING", datestring)
HAPI_PostDouble("DUMmyscript_DATENUMBER", datenumber)
```

This is a Win* for MOOS



***According to me**

That was Part 1

Scripting MOOS
(i.e. Rapid Prototyping)

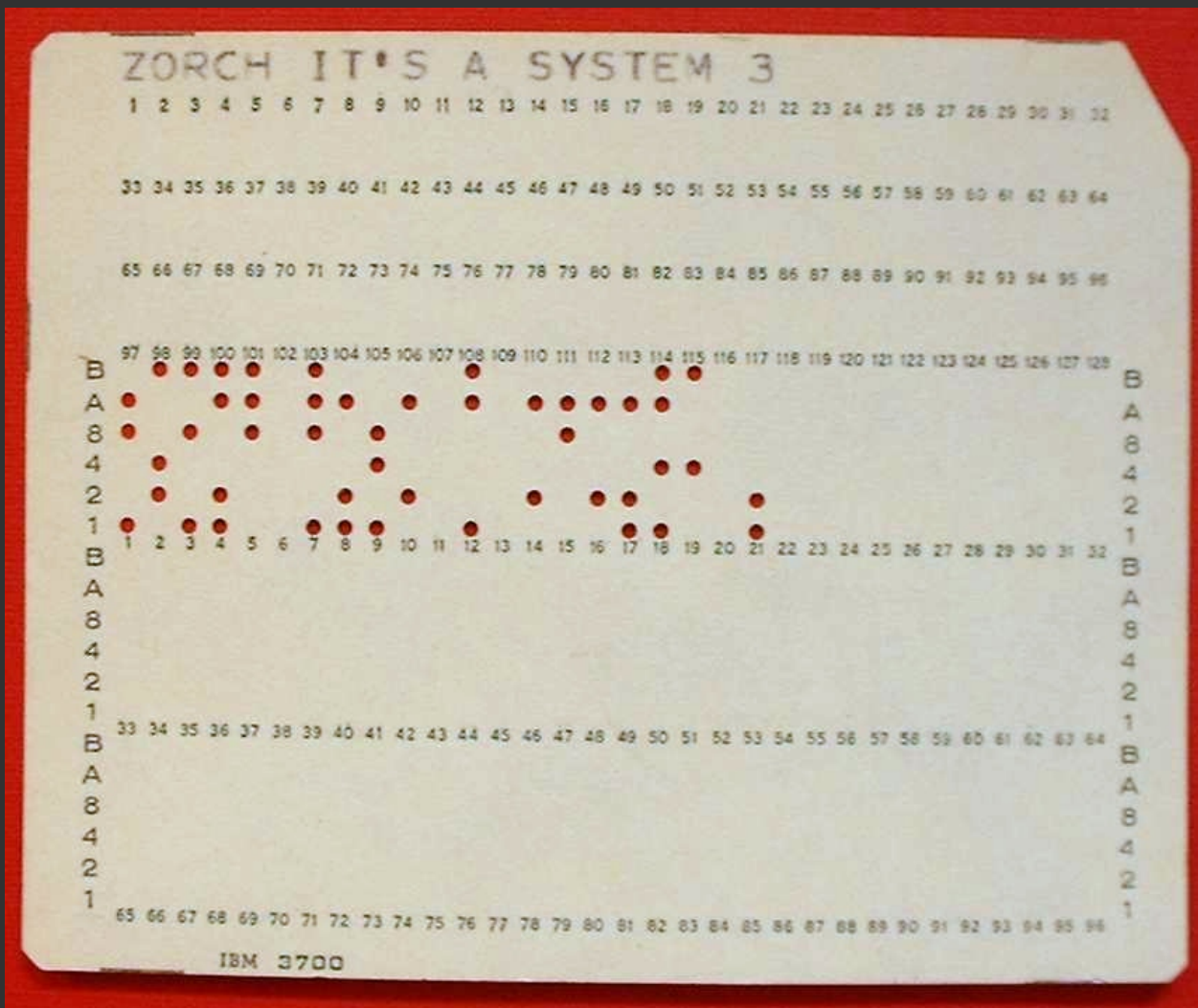
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- I. **Make MOOS more user-friendly**
- II. **Make better use of developers' time**

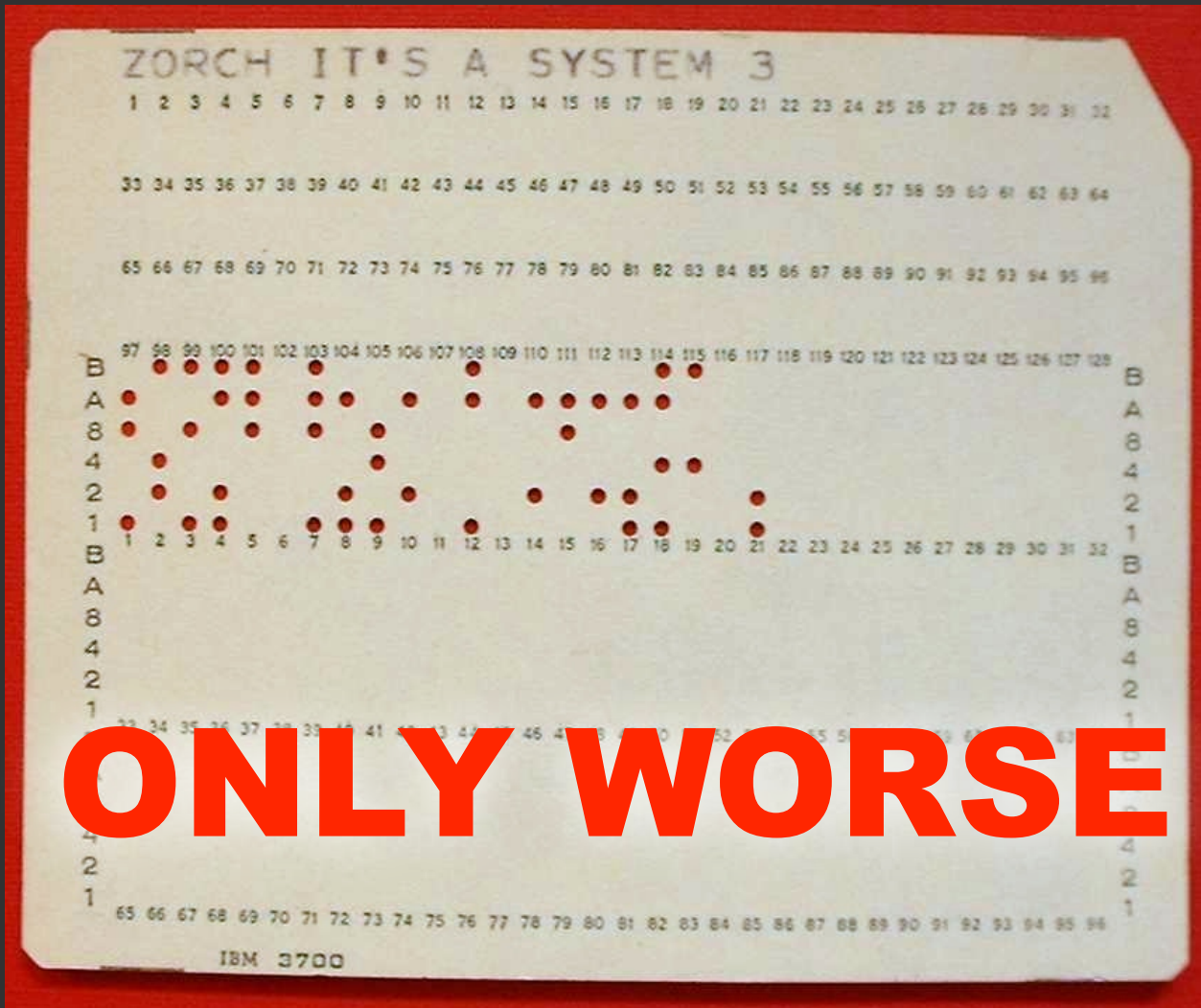
Part 2 of 2

Configuring MOOS

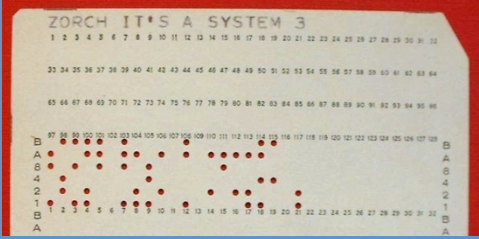
It's a lot like this.



It's a lot like this.



MOOS vs Punchcard

		<code>.moos</code>
Invented in	1725	2001
Used for data input	✓	✓
Supports quote marks	✓	✗
Spaces in strings	✓	✗

Improving MOOS Config

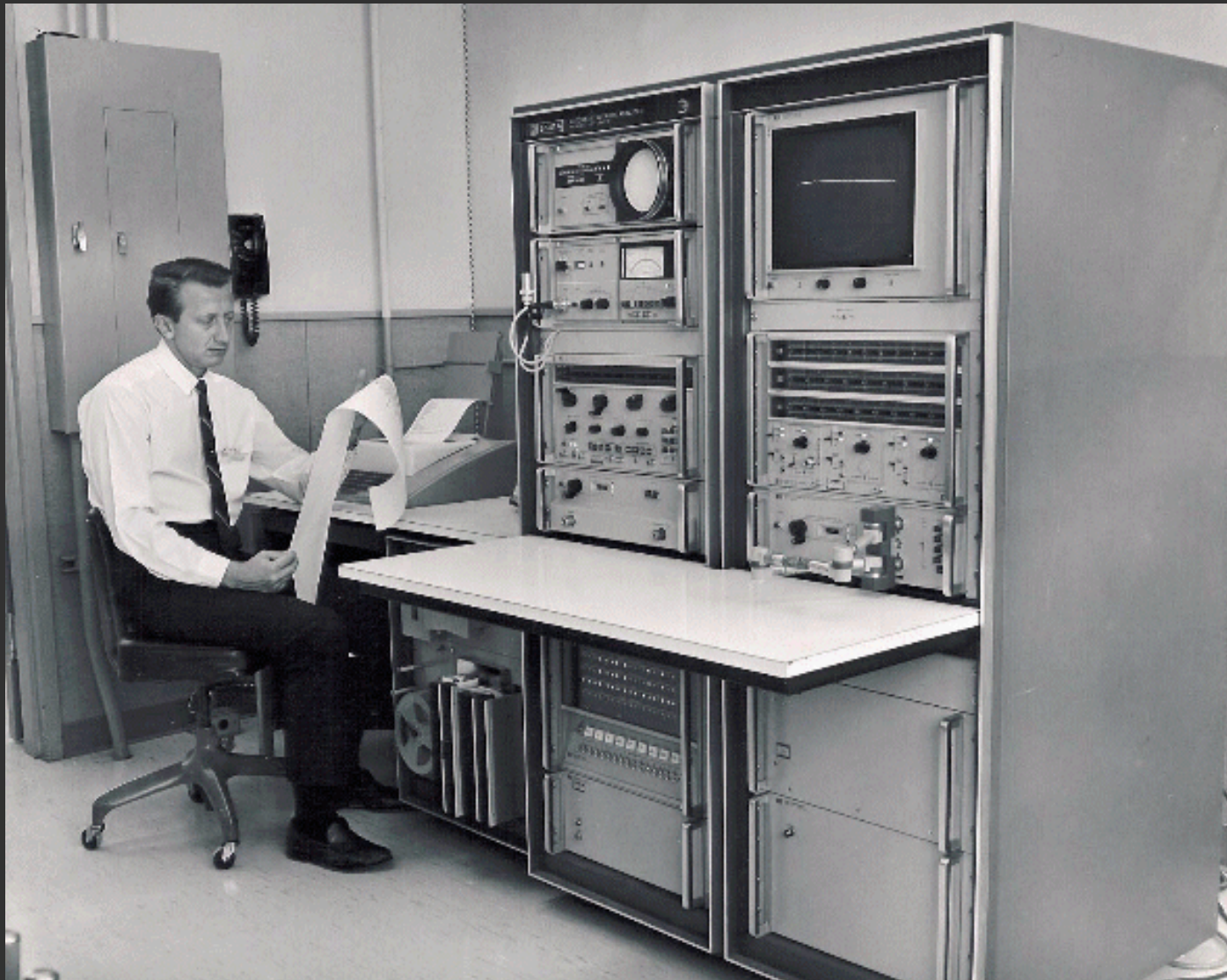
Plug systems:

**programmatically generating
MOOS configuration**

Improving Punch Cards



Eliminating the Middleman



the programming language

Lua



How It Works

C++ Environment

OnStartup()

Lua Environment

Lua File

```
iGPS = {  
    type = "garmin",  
    origin_lat = 42.234,  
    origin_lon = -76.333,  
}
```

How It Works


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iGPS = {  
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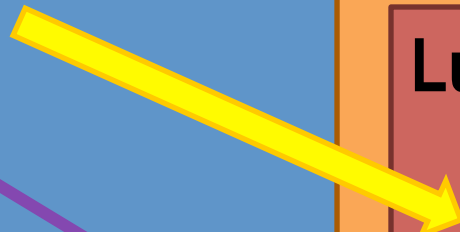
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How It Works

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- SomethingElegant()

.moos Syntax

```
ServerHost = localhost
ServerPort = 9000
```

```
// this is a comment
```

```
ProcessConfig = pLuaCfg
```

```
{
```

```
    aString          = MyStringValueNoSpaces
```

```
    aSpacedString   = S P A C E S
```

```
    aDouble          = 3.141
```

```
    aBoolTrue        = true
```

```
    aBoolNotTrue     = false
```

```
    aMultiString     = a
```

```
    aMultiString     = b
```

```
    aMultiString     = and so on
```

```
    aNullVal         =
```

```
}
```

Lua Syntax

```
ServerHost = "localhost"  
ServerPort = 9000
```

```
-- this is a comment
```

```
pLuaCfg = {
```

```
    aString      = "MyStringValueNoSpaces",
```

```
    aSpacedString = ("S P A C E S"):gsub(" ", ""),
```

```
    aDouble      = 3.141,
```

```
    aBoolTrue    = true,
```

```
    aBoolNotTrue = false,
```

```
    aMultiString = {  
        "a",  
        "b",  
        ("and so on"):gsub(" ", ""),  
    },
```

```
    aNullVal     = nil,
```

```
}
```

**Also, it's backwards
compatible with the
MOOS API.**

**Also, it's backwards
compatible with the
MOOS API.**

**I have a patch that
demonstrates it.**

That was Part 2

Configuring MOOS
(...Better than Punch Cards)

This Has Been:

**How We Can Make MOOS
Work Better For
Everyone**

Ask Me Anything