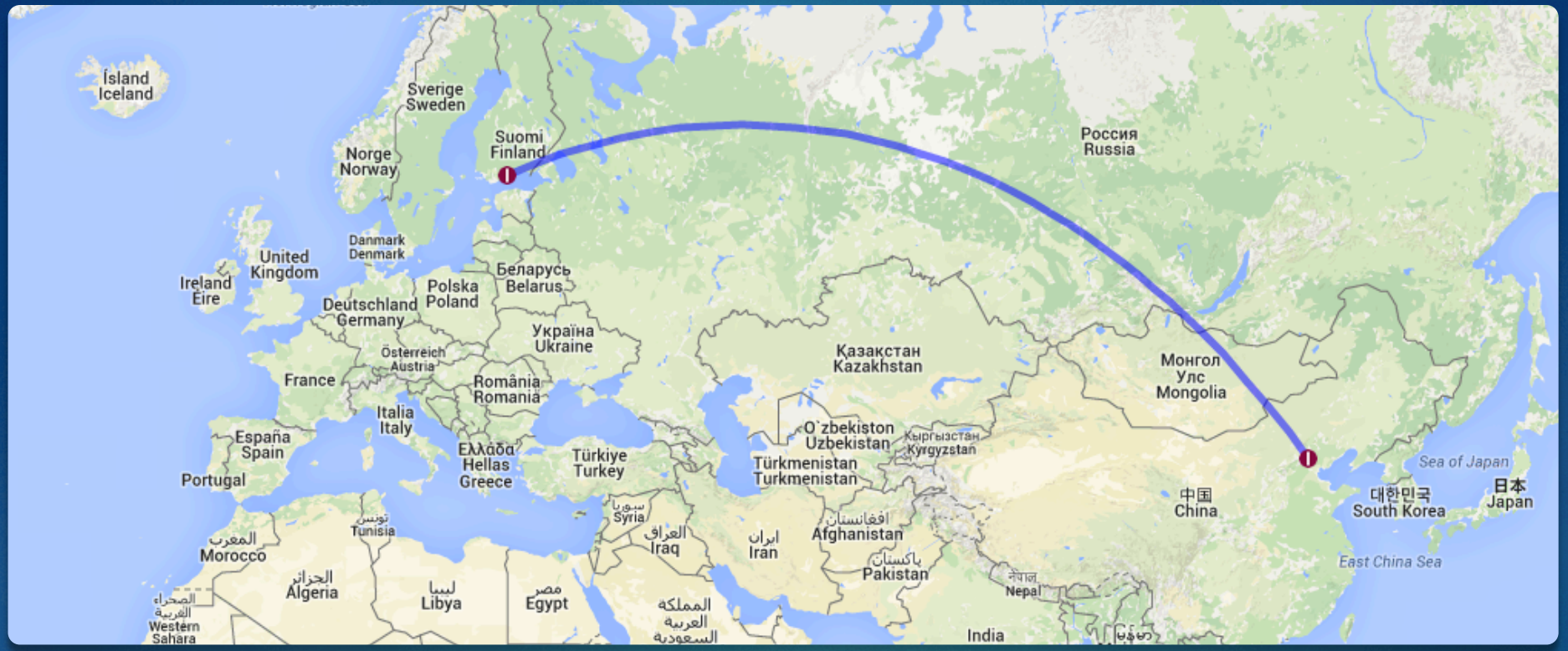
Developing OpenResty Framework

USING DECOUPLED LIBRARIES

by Aapo Talvensaari @ OpenResty Con 2015



Where Did I Get Here?

About 6.500 Kilometers – Almost Nothing Compared to The Length of The Great Wall of China

Who Am I?

PROFESSIONALLY

WEB PROGRAMMER SINCE 90'S

ColdFusion ➠ ASP ➠ PHP ➠ Java ➠ ASP.NET ➠ OpenResty

SYSTEM ADMINISTRATOR

Linux and Windows Platforms, and Cloud

JOB

IT Manager at Aalto Capital Oy

Founder of Talvensaari Solutions Oy

What to Expect?

In addition to English with Finnish accent, I will show you some of my libraries and how they work together.

Checkout also Leaf Corcoran's Excellent Lapis Framework:

http://leafo.net/lapis/

- Short History
- Basis for Building Web Applications
  - Routing
  - Templating
  - Validation and Filtering
  - Sessions
  - Style Sheets
- Libraries
- Kronometrix Analytics

Why OpenResty?

- I wanted to expand skills, and learn something new
- I wanted to get a rid of gateway interfaces – less moving parts
- A real web server with scripting language support
  (Basically a new Apache + mod_php with a modern twist, e.g. Web Sockets support)
- I was already using Nginx
- Alternatives that I looked
  (All the alternatives actually looked really nice, but I felt more comfortable with OpenResty)
  - Node.js (I didn't enjoy JavaScript, and it wasn't using a real web server)
  - Python / Ruby (too object oriented, usually behind a gateway interface)
  - Go (not a scripting language, no particular web development focus)
- Simplicity, both in development and deployment, and Performance

OpenResty Stack

Nginx

by Igor Sysoev et al.

Web Server

OpenResty

by Yichun Zhang et al.

Web Application Server

Lua

by Roberto Ierusalimschy et al.

Programming Language

Routing

LUA-RESTY-ROUTE

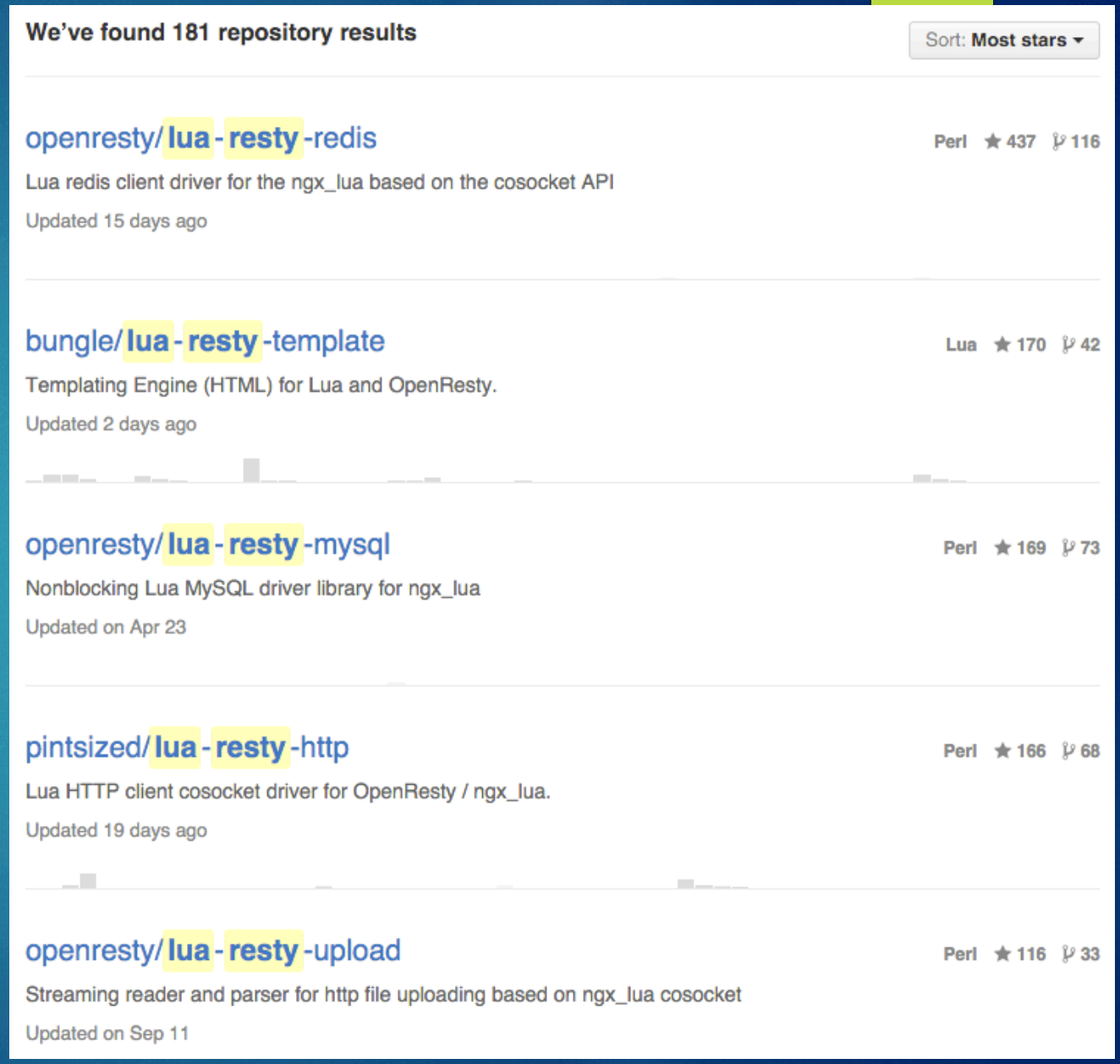
- Nginx already does routing! Why oh why?
  - Makes web development enjoyable! Works as a glue.
  - Nginx configuration can be fairly static
  - Nice DSL for Specifying Route Handlers
- Middleware
- Before and After Filters
- Web Sockets Routing
- Pluggable Matchers
  - Simple – ngx.re.match + pre-defined :string and :number matchers
  - Regex – ngx.re.match
  - Match – string.match
  - Equals – plain ==, no pattern or string matching

```
local r = require "resty.route"
local route = r.new()
-- Use a Middleware
-- (not needed in this example)
route:use "reqargs" {}
-- Add HTTP GET Route
route:get("/hello", function()
    ngx.print "世界你好"
end)
-- Dispatch the Request
route:dispatch()
```

Templating

LUA-RESTY-TEMPLATE

- One of the Top OpenResty Libraries in GitHub
- It's a Compiling Templating Engine
- Just Another Way to Write Lua
  - Almost all you can do in Lua, you can do in Template
  - Basically it is just plain string concatenation after all
    (white space and line-feed handling is fine tuned)
- Supports Lua / LuaJIT / OpenResty
- Handwritten Parser Using string.find



```
<!DOCTYPE html>
<html lang="{{lang}}">
<head>
    <meta charset="{{charset}}">
    <title>{{title}}</title>
    {*blocks.styles*}
    {#
        Commented out, because it causes a problems (see issue #35):
        <script src="js/analytics.js"></script>
    #}
    {-head_scripts-}
    <script src="js/app.js"></script>
    {-head_scripts-}
</head>
<body>
{-raw-}
    Everything inside here is outputted as is, e.g. {{not evaluated}}
{-raw-}
{(include/header.html)}
{[concat({"include/navigation", access.level, ".html"}, "-")]}
<section id="main">
    {* view *}
</section>
{(include/footer.html)}
{% for _, script in ipairs(scripts) do %}
    <script src="{{script}}"></script>
{% end %}
{*blocks.head_scripts*}
</body>
</html>
```

```
context=(...) or {}
local function include(v, c)
    return template.compile(v)(c or context)
end
local ___,blocks,layout={},blocks or {}
___[#___+1]=[=[
<!DOCTYPE html>
<html lang="]=]
___[#___+1]=template.escape(lang)
___[#___+1]=[=[
">
<head>
    <meta charset="]=]
___[#___+1]=template.escape(charset)
___[#___+1]=[=[
">
    <title>]=]
___[#___+1]=template.escape(title)
___[#___+1]=[=[
</title>
    ]=]
___[#___+1]=template.output(blocks.styles)
blocks["head_scripts"]=include[=[
    <script src="js/app.js"></script>
    ]=]
___[#___+1]=[=[
</head>
<body>
]=]
___[#___+1]=[=[
    Everything inside here is outputted as is, eg. {{not evaluated}}
]=]
```

```
___[#___+1]=include([=[include/header.html]=])
___[#___+1]=[=[

]=]
___[#___+1]=include(concat({"include/navigation", access.level, ".html"}, "-"))
___[#___+1]=[=[

<section id="main">
    ]=]
___[#___+1]=template.output( view )
___[#___+1]=[=[

</section>
]=]
___[#___+1]=include([=[include/footer.html]=])
___[#___+1]=[=[

]=]
for _, script in ipairs(scripts) do
    ___[#___+1]=[=[
    <script src="]=]
    ___[#___+1]=template.escape(script)
    ___[#___+1]=[=[
"></script>
]=]
end
___[#___+1]=template.output(blocks.head_scripts)
___[#___+1]=[=[

</body>
</html>]=]
return layout and include(layout,setmetatable({view=template.concat(___),blocks=blocks},{__index=context})) or
template.concat(___)
```

Validation and Filtering

LUA-RESTY-VALIDATION

- Both Validation and Filtering
- Validation and Filter Chaining
- Reusable Validators
  (Define Once, Use in Many Places)
- Automatic Conditional Validators
- Group Validators and Filters
- Easy to Extend
- Report Errors in Frontend, JSON Friendly
- Send Data to Backend
- Stop Validators
  (e.g. optional)

```
local v        = require "resty.validation"
local validate = {
    nick       = v.string.trim:minlen(2),
    email      = v.string.trim.email,
    password   = v.string.trim:minlen(8)
}
-- First we create single validators
-- for each form field
local register = v.new{
    nick       = validate.nick,
    email      = validate.email,
    email2     = validate.email,
    password   = validate.password,
    password2  = validate.password
}
-- Next we create group validators for email
-- and password:
register:compare "email    == email2"
register:compare "password == password2"
-- And finally we return from this forms module
return {
    register = register
}
```

Sessions

LUA-RESTY-SESSION

- Secure Defaults
- Configurable from Nginx Config or Lua Code
- Plugins for
  - Client and Server Storages
    (Cookie, Shared Memory, Memcache, Redis)
  - Ciphers
    (AES, HMAC)
  - Encoders
    (Base64 and Base16)
  - Serializers
    (JSON)
  - Identifiers
    (WIP, Random, JWT, UUID)

```lua
local session = require "resty.session"

-- Construct and start a session
-- (new, and open also available)
local s = session.start()

-- Store some data to session
s.data.name = "OpenResty Fan"

-- Save a session
s:save()

-- Destroy a session
s:destroy()

-- Regenerate a session
-- (e.g. when security context changes)
s:regenerate()
```

Style Sheets

LUA-RESTY-SASS

- Syntactically Awesome Style Sheets
- LuaJIT FFI Bindings to libSass
- Automatic Online Compilers for OpenResty
- Caching to Normal CSS Files Once Compiled
- Save-And-Refresh Development
  - A Good and a Bad Thing: Errors in Sass File prevents compiling to CSS
    Errors are catched earlier, but works differently than with plain CSS
- Deploy Sass Files Directly to The Production, No Build Needed
- More about Sass at http://sass-lang.com/

Demo

HOW THIS ALL WORKS TOGETHER?

Source Code Available at github.com/bungle/iresty

Libraries

COMMON NEEDS IN WEB DEVELOPMENT

Excel	➠ LUA-RESTY-LIBXL
Cryptography	➠ LUA-RESTY-NETTLE
Universally Unique Identifiers	➠ LUA-RESTY-UUID
Audio Metadata	➠ LUA-RESTY-TAGLIB
Markdown	➠ LUA-RESTY-HOEDOWN
File Information	➠ LUA-RESTY-FILEINFO
Translations	➠ LUA-RESTY-GETTEXT
Unicode	➠ LUA-RESTY-UNISTRING
JSON Pretty Formatting	➠ LUA-RESTY-PRETTYCJSON

CHECK MY GITHUB ACCOUNT FOR MORE

Excel

LUA-RESTY-LIBXL

LuaJIT FFI to a LibXL Library – a Library that Can Read and Write Excel Files

- LibXL
  - Proprietary Library (from Slovakia)
  - Supports XLS and XLSX Formats
  - Pricing Starts from $ 199.00
  - Source Code for The Library is Available for $ 2499.00
  - High Performance
  - No Extra Dependencies
- lua-resty-libxl
  - Nice Lua API (almost full featured*)

    * some Sheet APIs are still not finished

```lua
local excel = require "resty.libxl.book"
local book = excel.new()
book:load "demo.xlsx"
local sheet = book.sheets[1]
local value = sheet:read(1, 1)
sheet:write(1, 1, value + math.pi)
book:save "output.xlsx"
```

- Features
  - Pictures
  - Formats
  - Fonts and Colors
  - Hyperlinks
  - Equations

Cryptography

LUA-RESTY-NETTLE

LuaJIT FFI Bindings to GNU Nettle Library – a Low Level Cryptography Library

- Hash Functions
  - SHA1, SHA2, SHA3
  - MD2, MD4, MD5
  - RIPEMD160, GOSTHASH94
- Keyed Hash Functions
  - HMAC
    - SHA1, SHA2
    - MD5
    - RIPEMD160
  - UMAC
  - Poly1305
- Key Derivation Functions
  - PBKDF2
    - SHA1
    - SHA2
- Randomness
  - Yarrow
  - Knuth's Lagged Fibonacci
- ASCII Encoding
  - Base16, Base64, URL-safe Base64

Cryptography

LUA-RESTY-NETTLE

- Cipher Functions
  - AES
  - ARCFOUR
  - ARCTWO
  - BLOWFISH
  - Camellia
  - CAST128
  - ChaCha
  - DES
  - DES3
  - Salsa20
  - SERPENT
  - TWOFISH
- Cipher Modes
  - ECB
  - CBC
  - CTR
- AEAD
  Authenticated Encryption with Associated Data
  - EAX for AES
  - GCM for AES / Camellia
  - CCM for AES
  - ChaCha-Poly1305
- Public Key Algorithms
  Bindings for these are still work in progress, ☹.

Kronometrix

A REAL-TIME ANALYTICS APPLIANCE DESIGNED FOR TIME SERIES DATA ANALYSIS

- Build on OpenResty and Lua
- Using Redis as a Backend Store
- 1,000 Recording Devices per Appliance in Real-Time
- Data Recorders
  - Aviation Meteorology
  - Computer Performance Metrics
    - Windows
    - Linux
    - BSD
    - Solaris
  - Climatology
- Architecture of The Appliance
  - Authentication Layer
    - OpenResty Server
    - Redis Authentication Database
  - Messaging Layer
    - OpenResty Server
  - Kernel Layer
    - OpenResty Server
    - Redis Statistics Database
  - Aggregate Layer
    - OpenResty Server
    - Redis Aggregates Database

OpenResty in a Future

IT'S BRIGHT FOR SURE

What I Will Be Doing?

- Adding Documentation
- Adding Tests
- Maintaining Existing Libraries
- More Libraries, and Bindings
  - lua-resty-password / -auth
  - lua-resty-chromelogger
  - lua-resty-cloudflare
- Start Contributing on **ngx_lua**
- A Modern Open Source CMS

What I Would Like to See?

- Uniting Chinese and Western Communities
- Package Management
- File APIs (Using Nginx File APIs?)
- Official Packages for Platforms
- LuaJIT Enhancements
  - Less NYIs
  - String Buffer
  - Lua 5.2 / 5.3 Support / Uncertainty
- Optimizing for LuaJIT is Hard

Questions?

aapo.talvensaari@gmail.com

bungle@github