PCEP - A Protocol for All Uses? How and when to extend an existing protocol

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Engineer (ɛndʒɪˈnɪə)

- **noun**
  1. A person who designs, builds, or maintains engines, machines, or structures
  2. A person who controls an engine, especially on an aircraft or ship
  3. A skilful contriver or originator of something: *the prime engineer of the approach*
- **verb**
  1. Design and build (a machine or structure)
  2. Modify (an organism) by manipulating its genetic material
  3. Skilfully arrange for (something) to occur

Oxford University Press 2014

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Other useful vocabulary

- **Bodge** (bɒdʒ) **verb**
  1. Make or repair (something) badly or clumsily
- **Botch** (bɒtʃ) **verb**
  1. Carry out (a task) badly or carelessly
- **Hack** (hak) **verb**
  1. Cut with rough or heavy blows
  2. Program quickly and roughly
  3. Manage; cope

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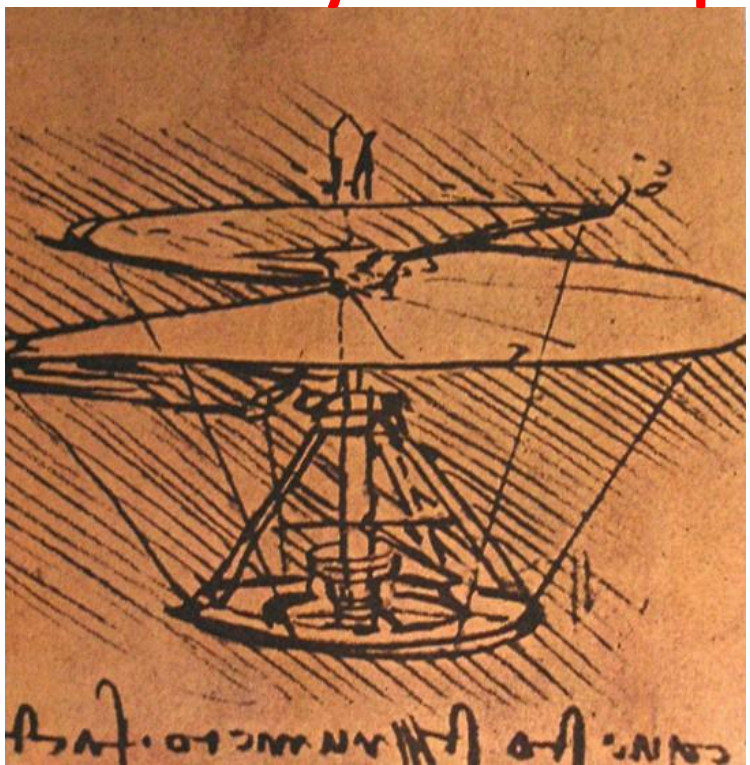
Oxford University Press 2014

Contrivance (kənˈtrʌɪv(ə)ns) noun

2. A device, especially in literary or artistic composition, which gives a sense of artificiality

2.1. A thing which is created skilfully and inventively to serve a particular purpose



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The Origins of PCEP

- Like PCE, PCEP had a very narrow purpose
  - Simple path computation request/response for MPLS-TE LSPs
- Initial proposals *and early implementations*
  - Used RSVP-TE Path messages
    - It is "kind of obvious": that is exactly what we will signal
    - Just use the TCP session to give context to the usage
  - It really worked
- But was that really extensible?
  - Even in the MPLS-TE context we needed multiple extensions
  - RSVP has a lot of baggage
- Result:
  - A new container protocol and re-use of RSVP objects

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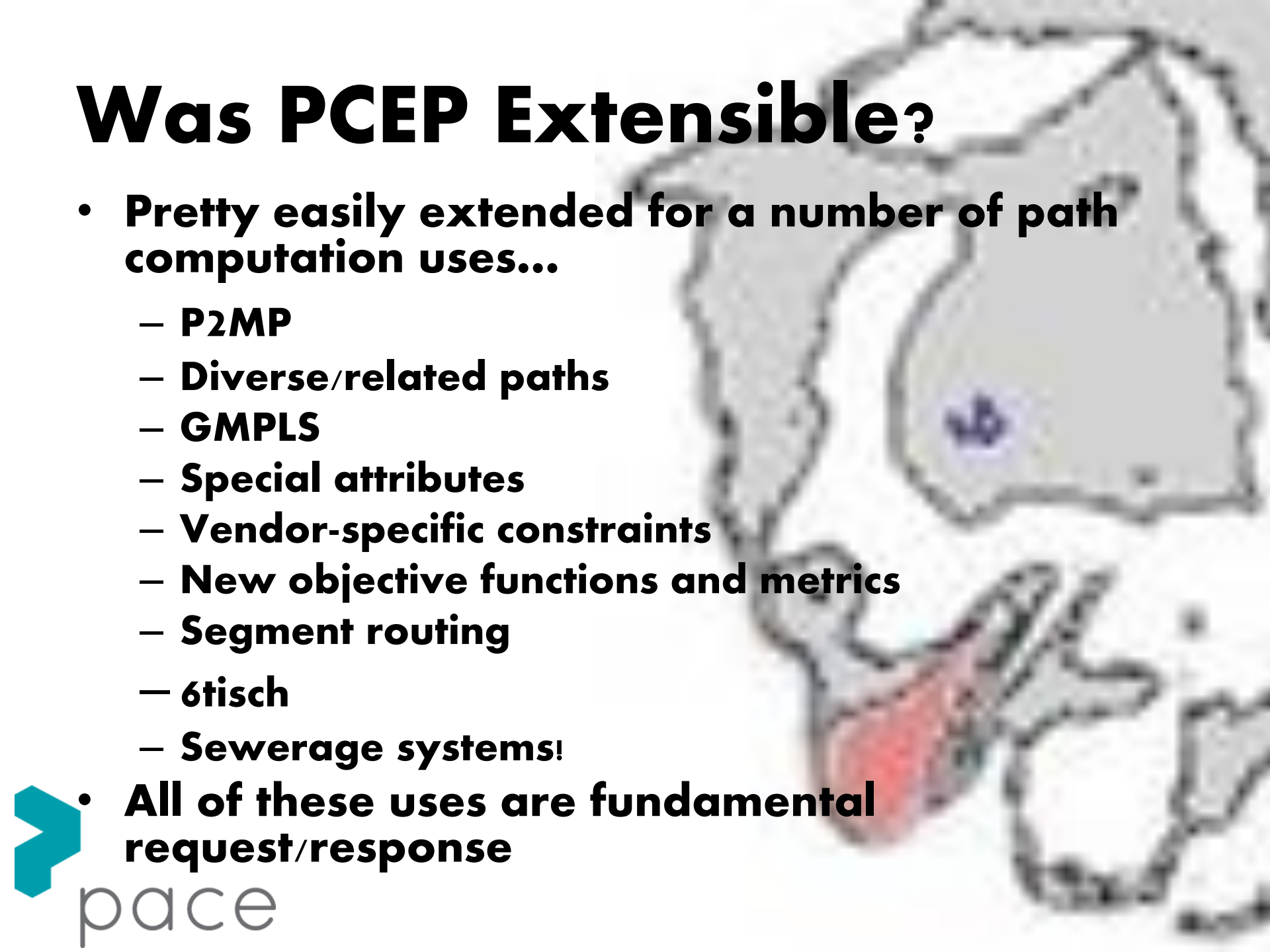
Was PCEP Extensible?

- Pretty easily extended for a number of path computation uses…
  - P2MP
  - Diverse/related paths
  - GMPLS
  - Special attributes
  - Vendor-specific constraints
  - New objective functions and metrics
  - Segment routing
  - 6tisch
  - Sewerage systems!
- All of these uses are fundamental request/response



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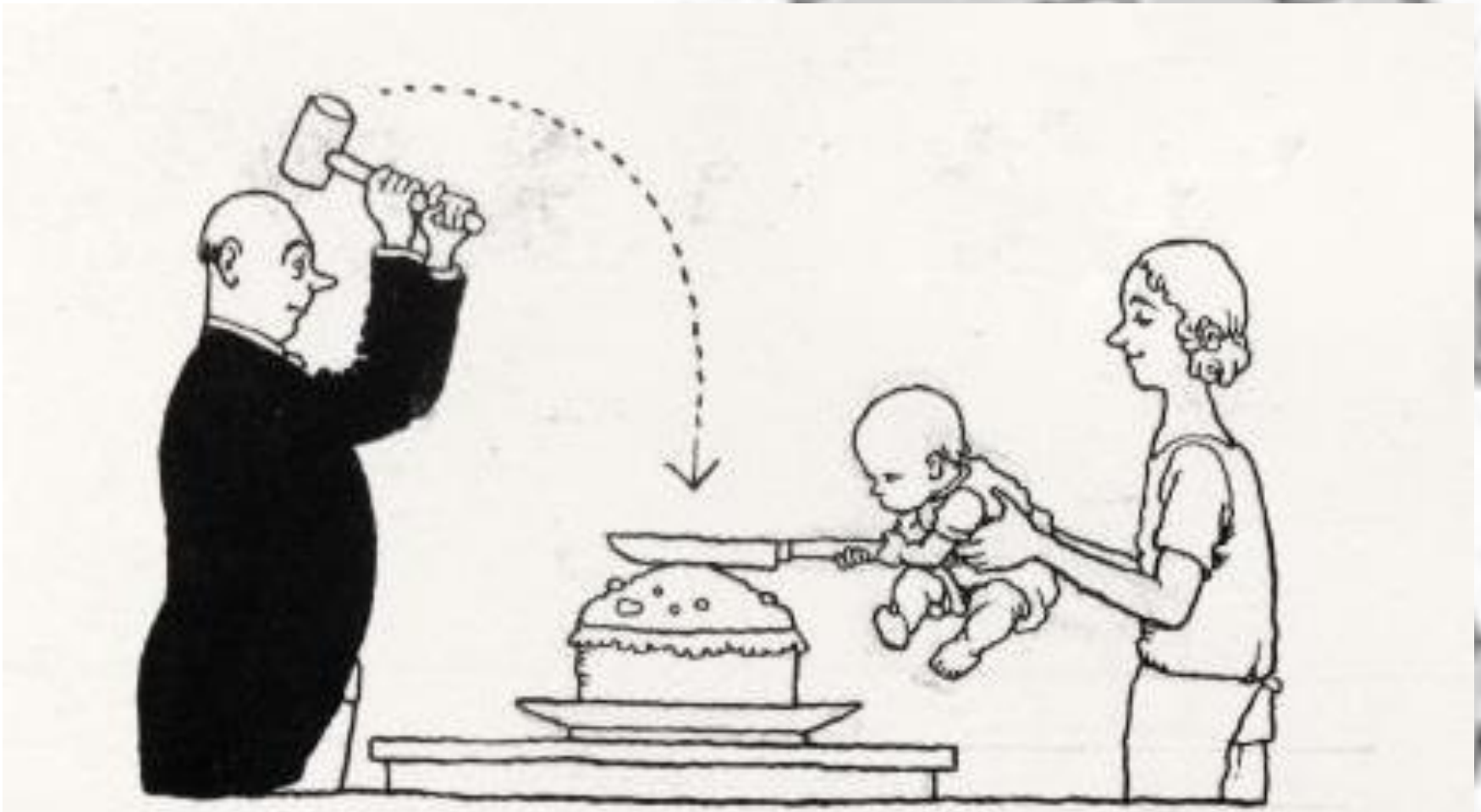
Just because you have a hammer...



George Emsden

Stateful PCE

- Recall that any PCE has network state
  - But this information is not gathered using PCEP
    - IGP
    - BGP-LS
    - "other mechanisms"
- Recall that transitory state per-computation exists
  - Please compute a path considering this other LSP
- Adding LSP state did not need to extend PCEP
  - Knowledge of paths already computed
  - Other mechanisms to collect LSP state
    - BGP-LS extensions?
- But it is "convenient" to extend PCEP
  - "Yes, I used that path you gave me"
  - "Here are some other LSPs I know about"
- And it is relatively easy to do

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Active PCE

- As far as the protocol is concerned, it is only a small step
  - "Please worry about these LSPs for me."
  - "Here is a path you didn't ask for."
    - Delegation
    - New LSPs
    - But no compulsion!
- Architecturally it is "interesting"
  - PCEP used to be the language spoken by the computation engine (PCE)
  - Now it is the language spoken by the network management system (NMS) that has a computation component
  - Doesn't make it wrong. Does make it different.

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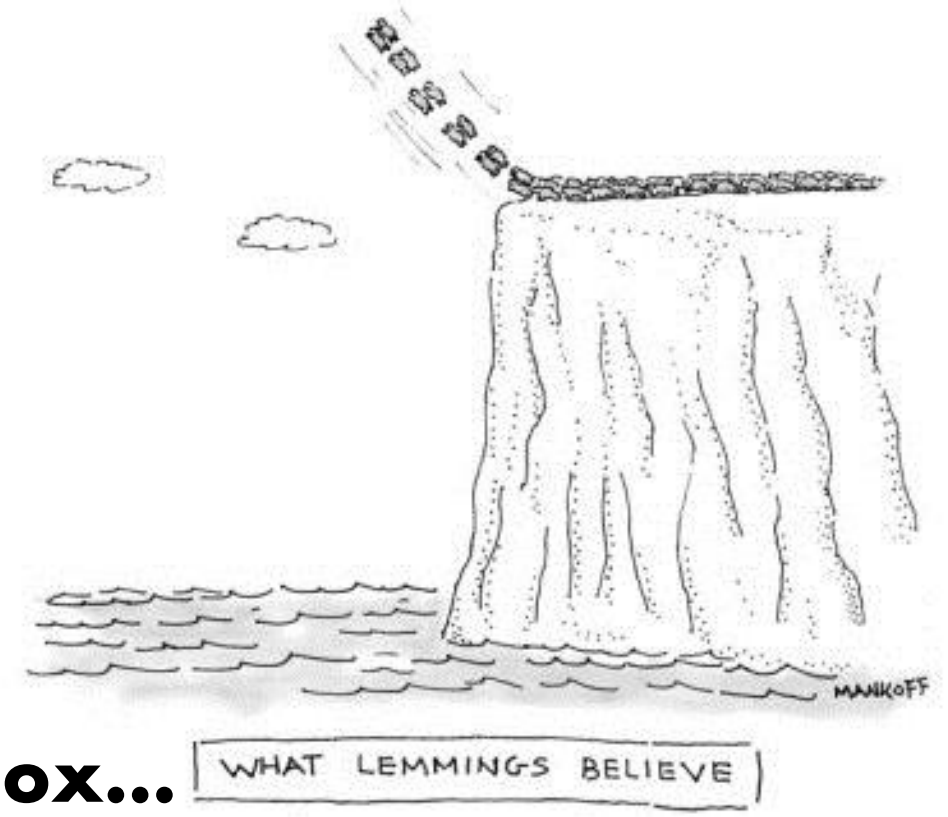
Where Do You Think You're Going?

- **Every journey begins with a single step**
  - **So watch out where you are going!**



Robert Mankoff : cryptomundo.com

- **But Zeno's paradox…**
  - **Or, as Aristotle put it…**
    - *That which is in locomotion must arrive at the half-way stage before it arrives at the goal*
  - **So we're safe, right?**

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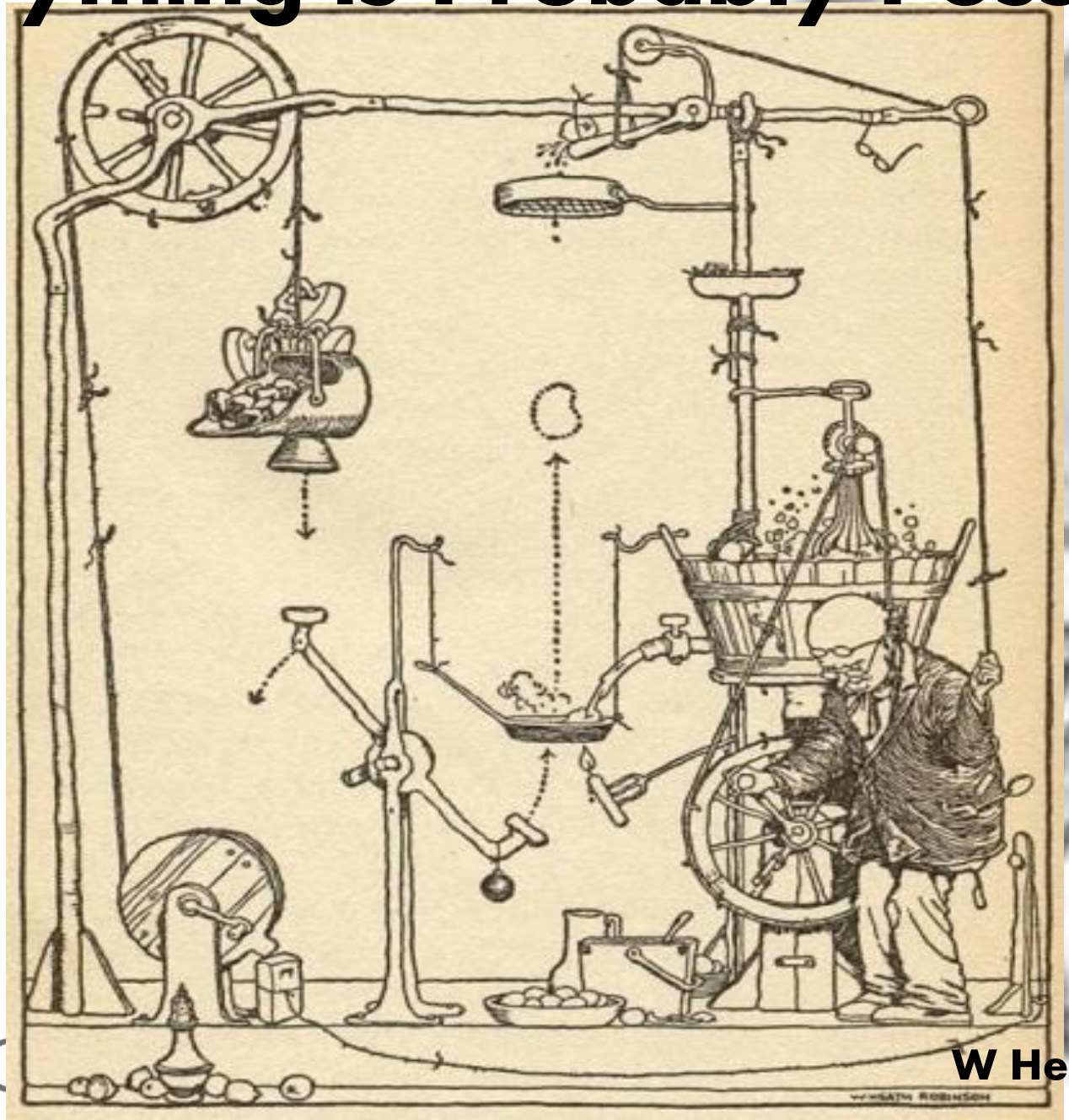
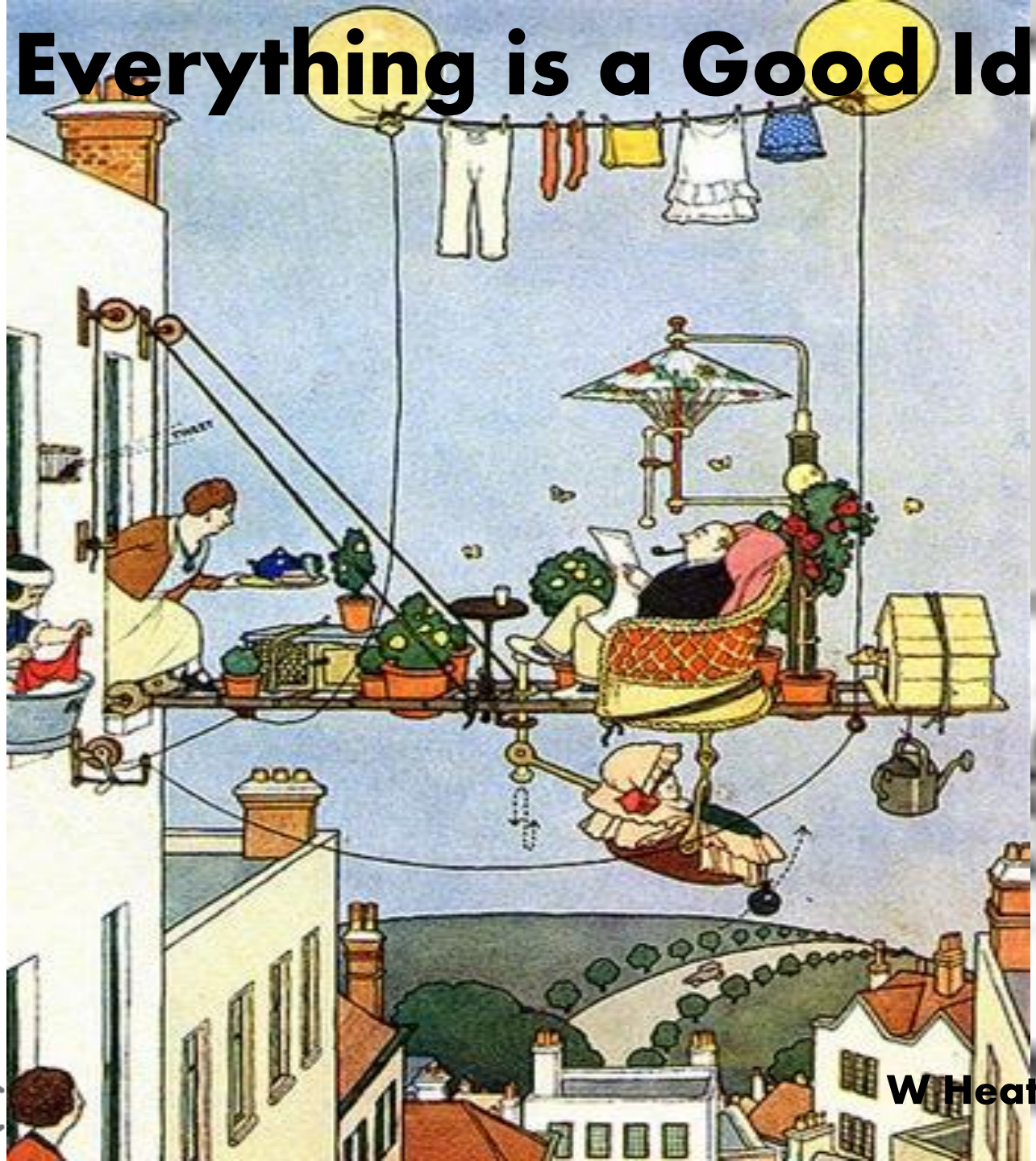
Everything is Probably Possible



W Heath Robinson

Not Everything is a Good Idea



W Heath Robinson

A Line in the Sand

- On cool reflection we all agree there are limits beyond which we will not go

- But then there is engineering expediency
- So how do we know when to stop?

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PCEP as a Management Protocol

- Advancing in baby steps
- Where is the line in the sand?
  - Path computation request/response
  - Delegation and new path suggestion
  - New LSP suggestion
  - New LSP request
  - New LSP demand
- Is there a train coming the other way?
  - A management protocol that might challenge PCEP

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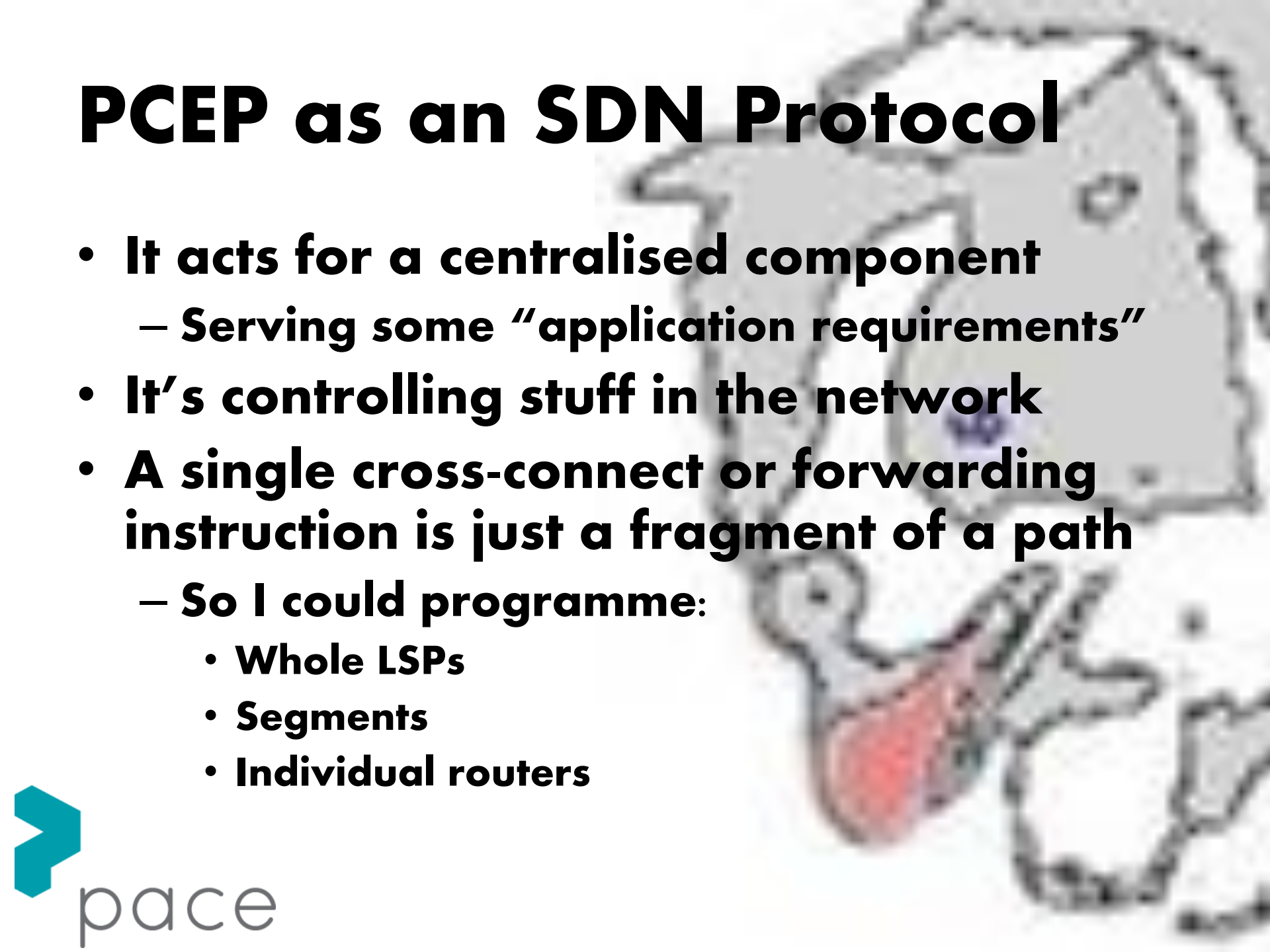
PCEP as an SDN Protocol

- It acts for a centralised component
  - Serving some "application requirements"
- It's controlling stuff in the network
- A single cross-connect or forwarding instruction is just a fragment of a path
  - So I could programme:
    - Whole LSPs
    - Segments
    - Individual routers



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PCEP as an Operations Protocol

- What is the biggest challenge with an LSP?
  - Knowing what to do with it
- Is it a virtual interface on the ingress?
- Is it a virtual link in a client network?
- How do I classify packets to use the it?
- How do I associate it with other LSP?
  - Protection etc.
- How do I report errors for an LSP?
- How do I reroute/quiesce/modify an LSP?

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Other Trains on the Track

- CLI is not a competitor
- SNMP never was a train or on this track
- Netconf/YANG
  - Via I2RS?
  - OpenDaylight?
- OpenFlow?
  - Increasing pressure in this direction
- IPFIX & Syslog

Heritage Auctions / tuesday-johnson.tumblr.com

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What Can We Learn from the IETF?

- The IETF standardises implementations
  - To some extent this means "Do what you like"
  - It is a recognition of expediency
- There is some concern for "purity"
  - Architecture is a nice thing
- A major concern is to retain stability
  - RFC 7279
    "An Acceptable Use Policy for New ICMP Types and Codes"
    - *Don't do things that will break deployed networks*
      - But PCEP probably doesn't fall into this category
- A host of well-known platitudes
  - Don't reinvent wheels
  - Keep it Simple Stupid (KISS)
  - Options are bad for interoperability
- RFC 4775
  "Procedures for Protocol Extensions and Variations"
- RFC 6709
  "Design Considerations for Protocol Extensions"

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A Look Inside RFCs 4775 and 6709

- **RFC 4755**
  - **Main concern is *process* for extension of IETF protocols**
    - **Through the IETF with proper review and consensus**
  - **Also discusses the technical risks**
    - **Potential damage to utility of protocol**
    - **Potential security risks**
    - **Increased interoperability issues or confusion**
- **RFC 6709**
  - **Mainly technical concerns**
    - **How to make a protocol extensible**
    - **Risks to critical protocols**
    - **Design for Interoperability**
      - **But note that PCEP is a quasi-application protocol running in a limited-scope domain**

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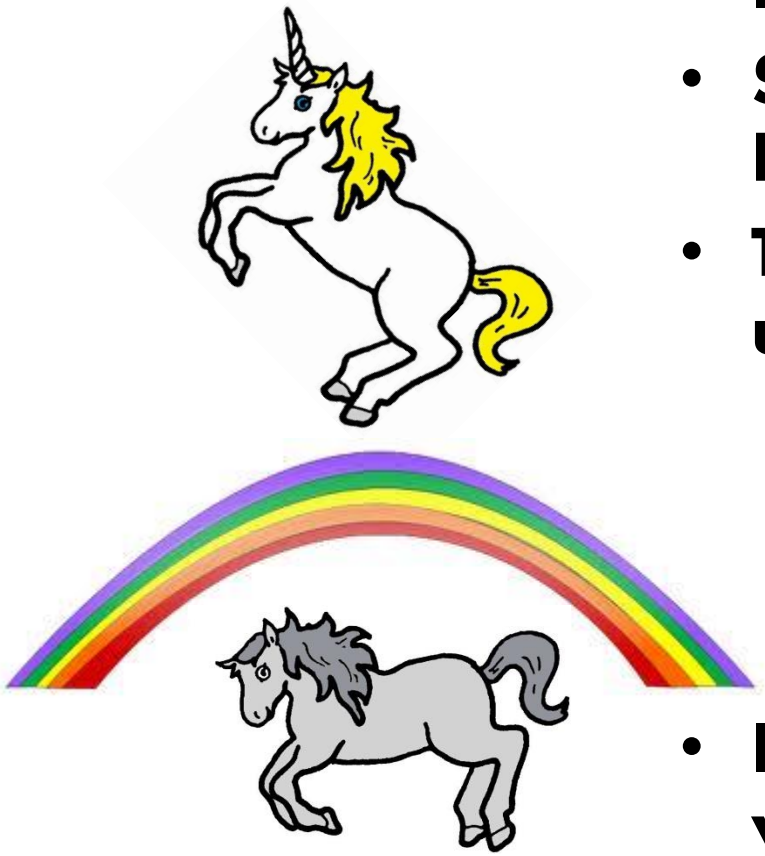
Why Do I Care?

- I have an over-strong emotional attachment
  - To the past
  - To the PCE architecture
- I also like things to be "right"

BESTFRIEND
MISSING
CHARLIE, MONKEY, LOST.

REWARD
100 BANANAS

Where Do I Draw the Line?



- I ***do*** draw a line
- Somewhere between Stateful PCE and full LSP management
- The answer comes from understanding
  - What function is needed
  - What other protocols can do
  - When a new protocol would be best
- I draw the line close to where we already are
  - RESTconf and YANG do the rest

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Why Should You Listen To Me?

- **Because I'm old?**
- **Because I have scars?**
- **Because I can see the future?**
- **Because you know I'm right!**