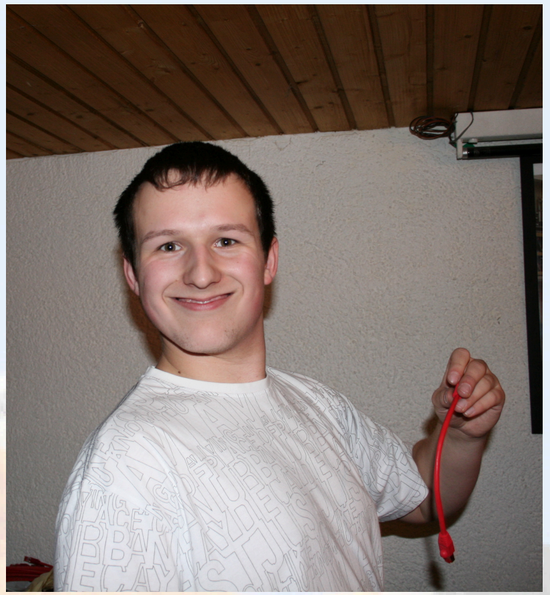
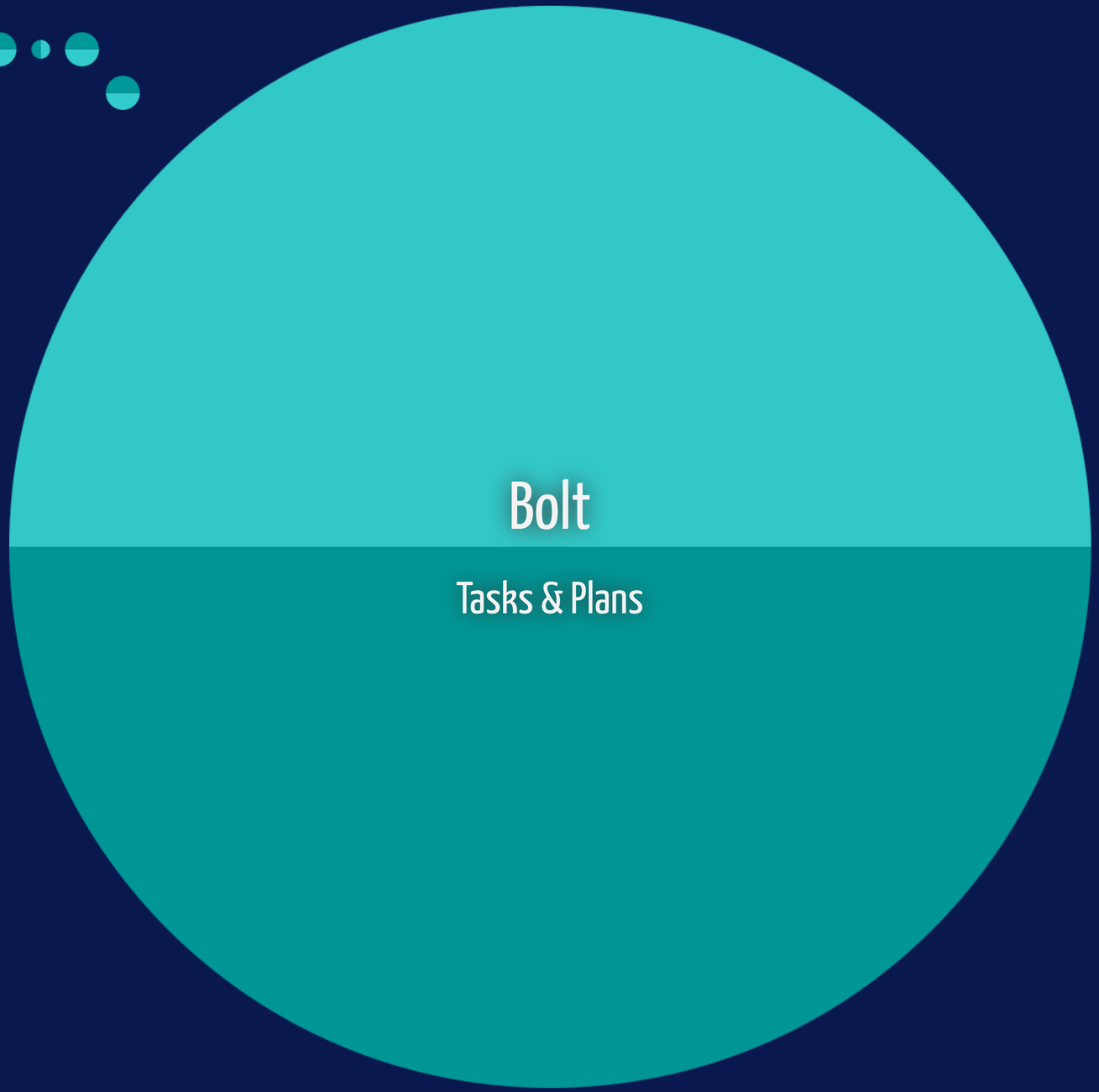
beladels

Doing mass PE upgrades in highly restricted environments

$ whoami

- Tim 'bastelfreak' Meusel
- Puppet Contributor since 2012
- Merging stuff on Vox Pupuli (Puppet Community) since 2015
- Vox Pupuli Project Management Committee member
- Senior IT Automation Consultant at betadots
- Certified Puppet Solution Consultant




Bolt
Tasks & Plans

Bolt

Tasks?!

- Runs tasks via ssh or WinRM on remote systems
  - CLI only

Bolt

Tasks?!

- Runs tasks via ssh or WinRM on remote systems
  - CLI only
- A task is a executable binary/script + json file

```
{
  "puppet_task_version": 1,
  "supports_noop": false,
  "description": "Rename branch",
  "parameters": {
    "control_repo_branch": {
      "description": "Control-repo branch",
      "type": "String"
    }
  }
}
```

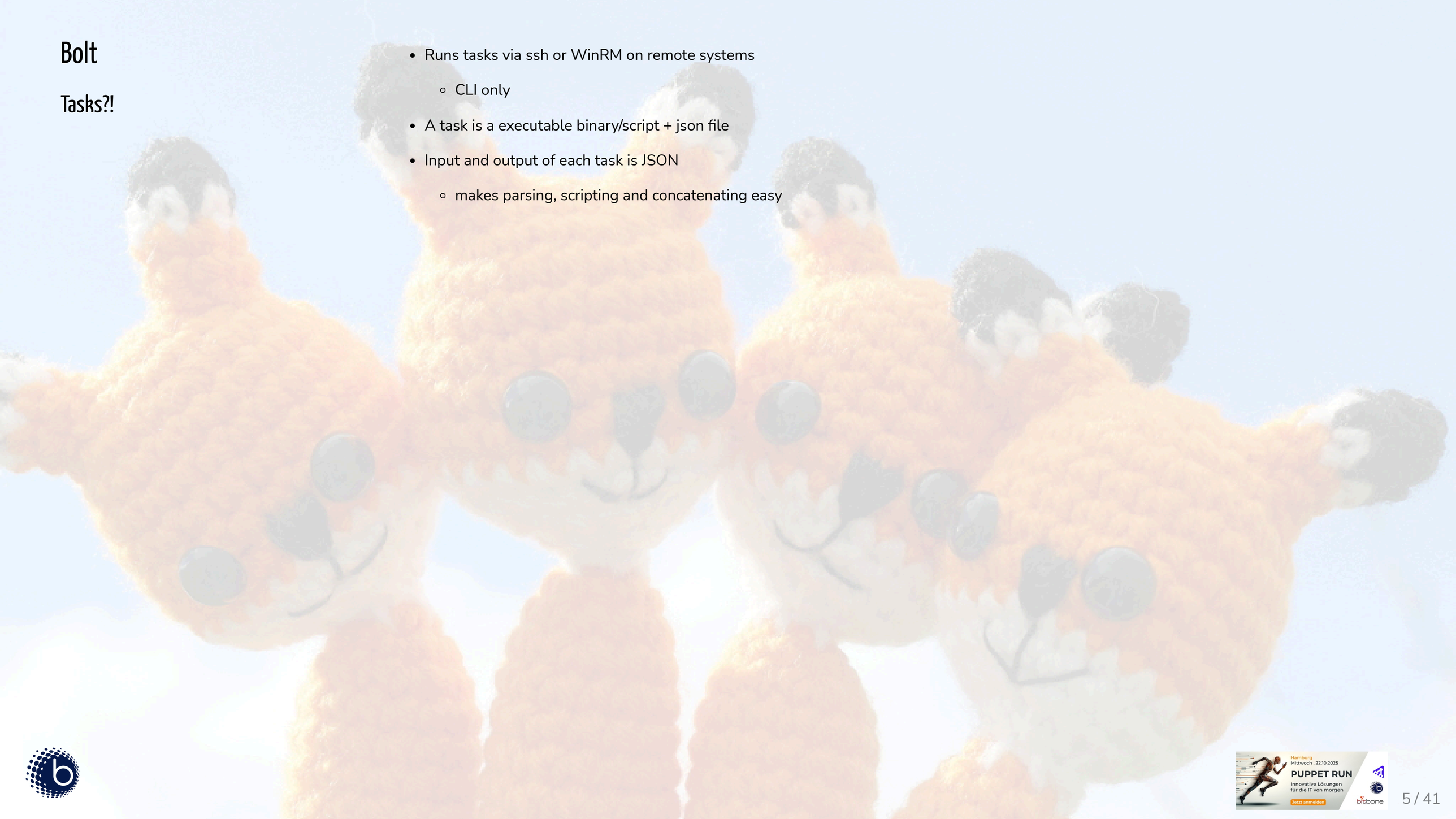
```
#!/bin/bash

pushd /tmp/control-repo || exit
git branch -m production old_prod
git branch -m "$PT_control_repo_branch" production
```

Bolt

Tasks?!

- Runs tasks via ssh or WinRM on remote systems
  - CLI only
- A task is a executable binary/script + json file
- Input and output of each task is JSON
  - makes parsing, scripting and concatenating easy



Bolt

Tasks?!

Plans?!

- Bolt Plans are written in Puppet DSL (or YAML)
- Plans apply puppet code, execute Bolt or Puppet functions, start tasks or other plans

```
# @summary Conference Demo plan
# @param message the string we want to paste to STDOUT
plan test::foo (
  String[1] $message = 'Hi Puppet.Run 2025!',
) {
  out::message($message)
  run_task('puppet_agent::install', get_targets('all'))
}
```

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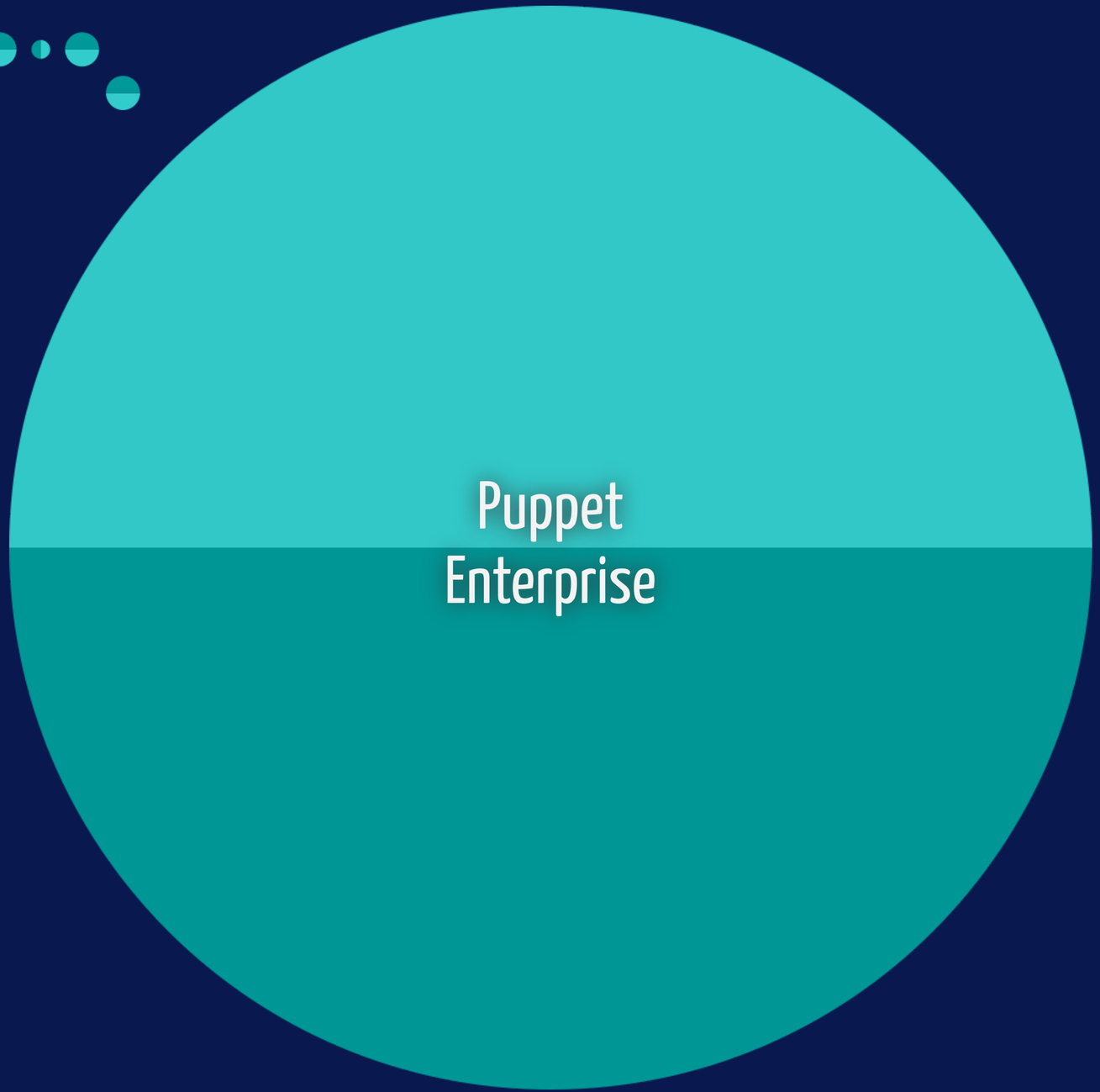
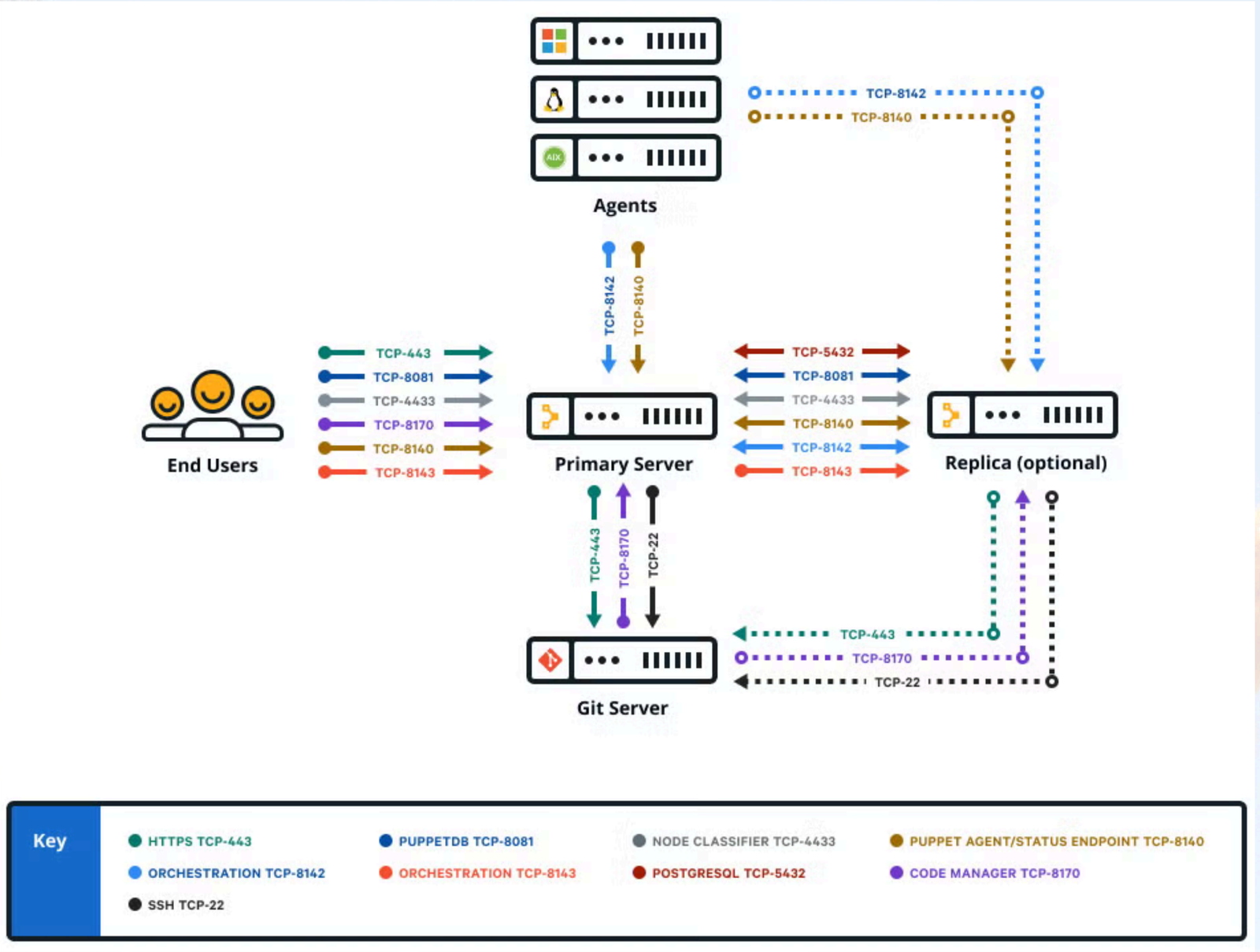
Bolt is the missing part in the ecosystem for imperative workflows and orchestration

It combines scripts and Puppet code


Puppet
Enterprise

PE

What?



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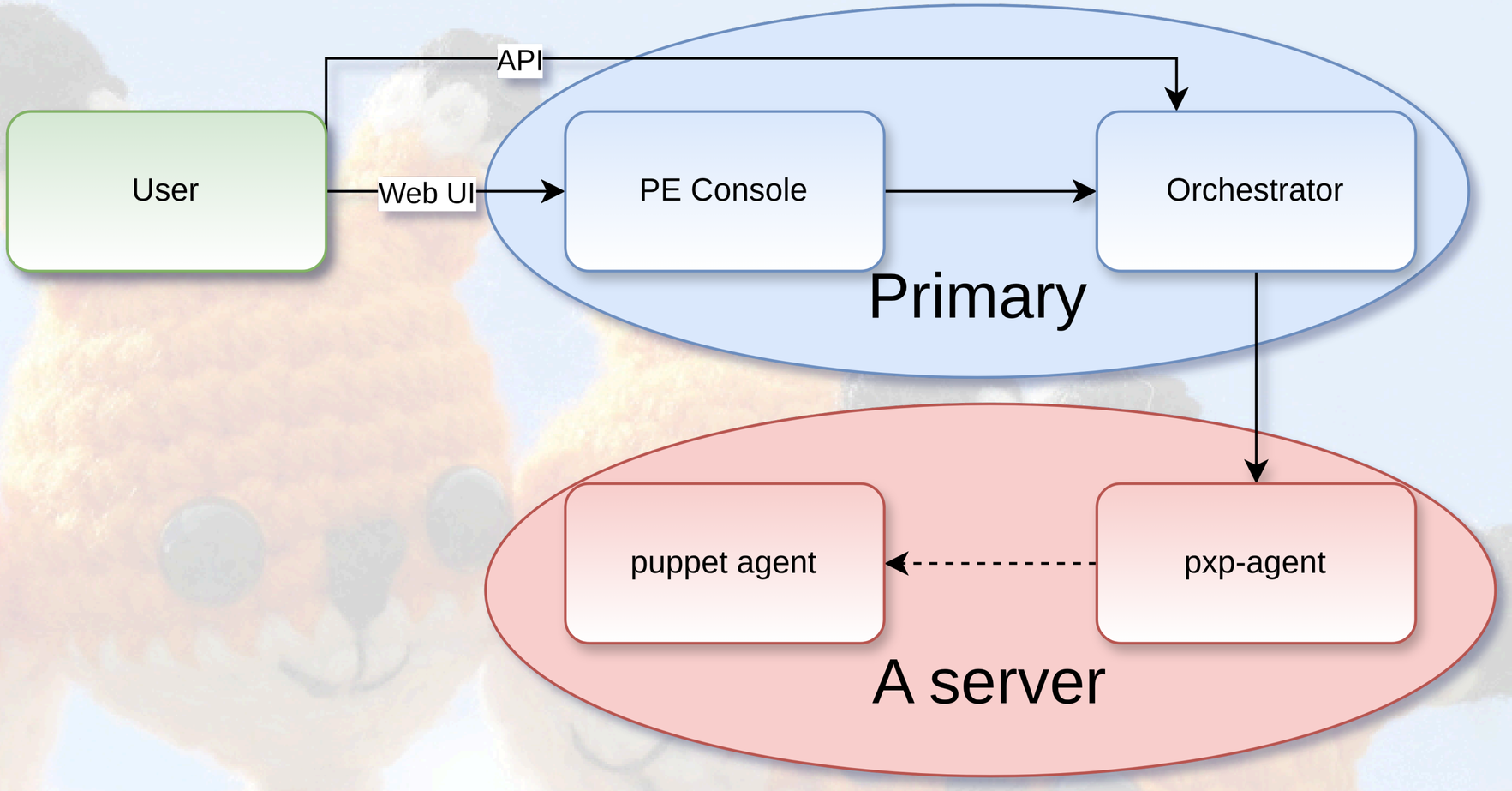
PE

What?



- Orchestrator can run Puppet tasks and Plans
- Basically an API & Web UI for bolt

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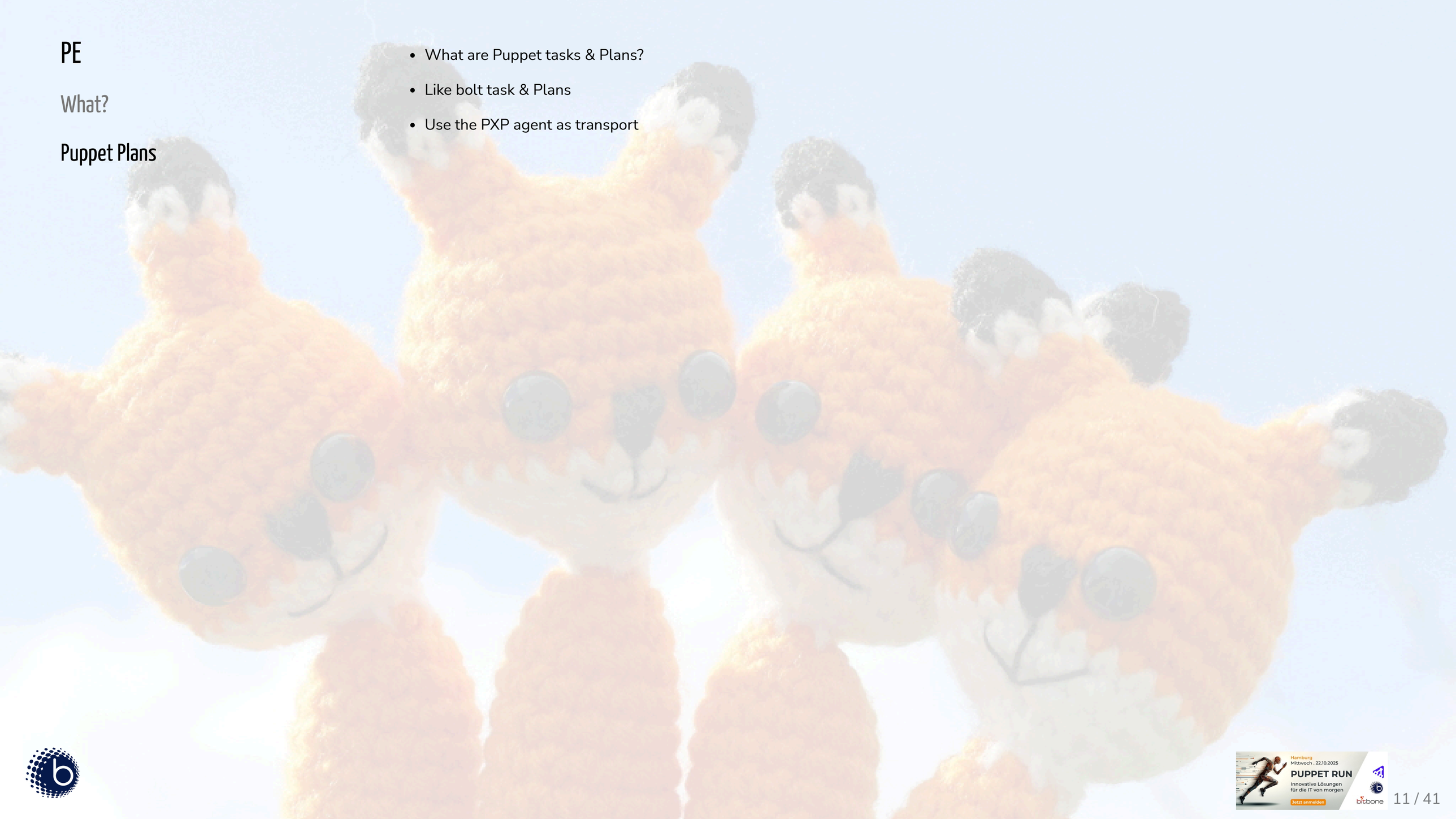
PE

What?

Puppet Plans

- What are Puppet tasks & Plans?
- Like bolt task & Plans
- Use the PXP agent as transport



PE

What?

Puppet Plans

- What are Puppet tasks & Plans?
- Like bolt task & Plans
- Use the PXP agent as transport
- Orchestrator is closed source, PXP agent is open source
- There are subtle differences between `Bolt plans` and `Plans in PE`
  - `Plans in PE` have less features?! https://www.puppet.com/docs/pe/2025.0/plans_limitations.html
  - There are plans to fix this in the future

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PE in highly restricted environments

A user story

PE

Setup

- An organisation with many regulations and restrictions

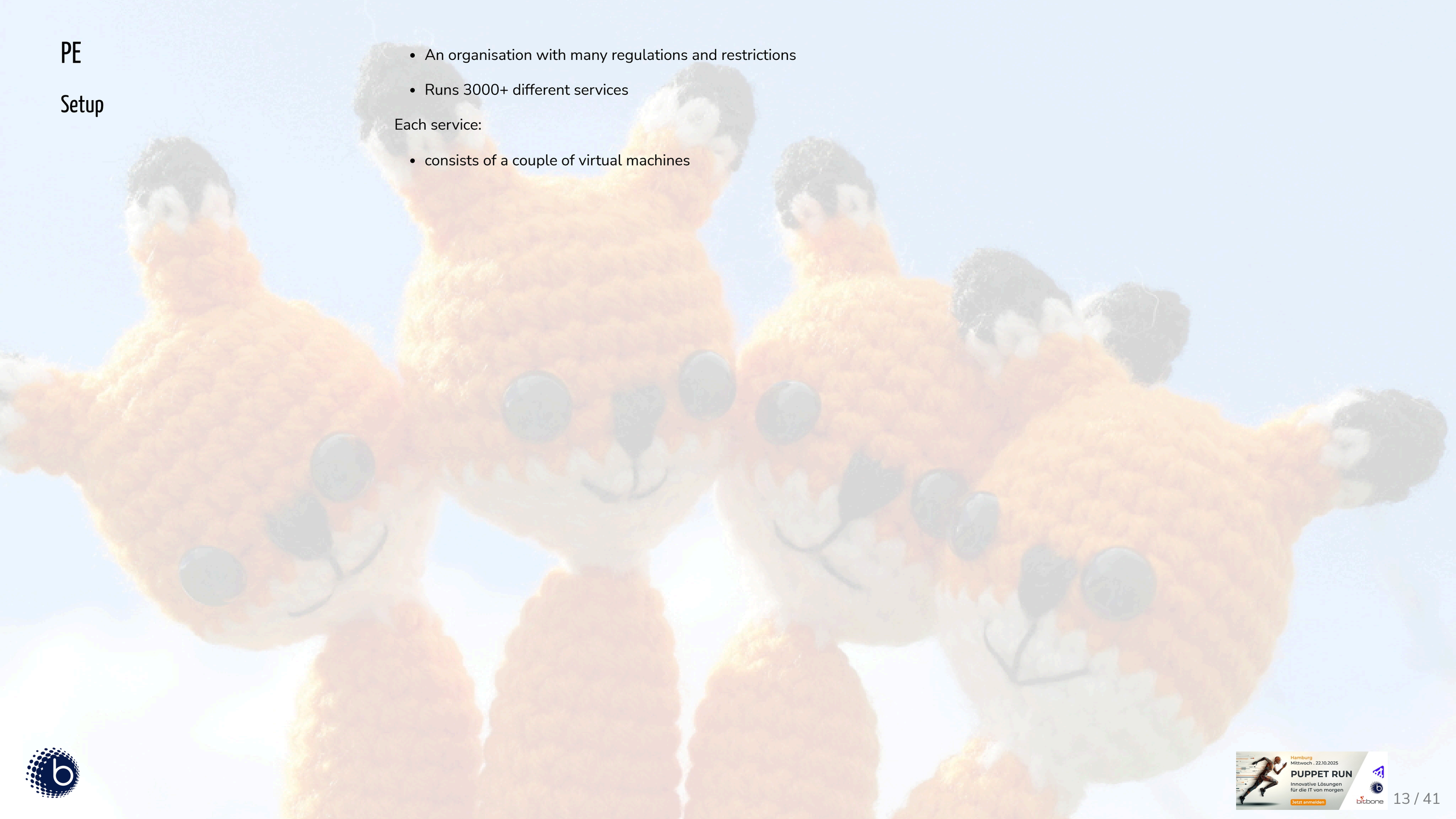
PE

Setup

- An organisation with many regulations and restrictions
- Runs 3000+ different services

Each service:

- consists of a couple of virtual machines



PE

Setup

- An organisation with many regulations and restrictions
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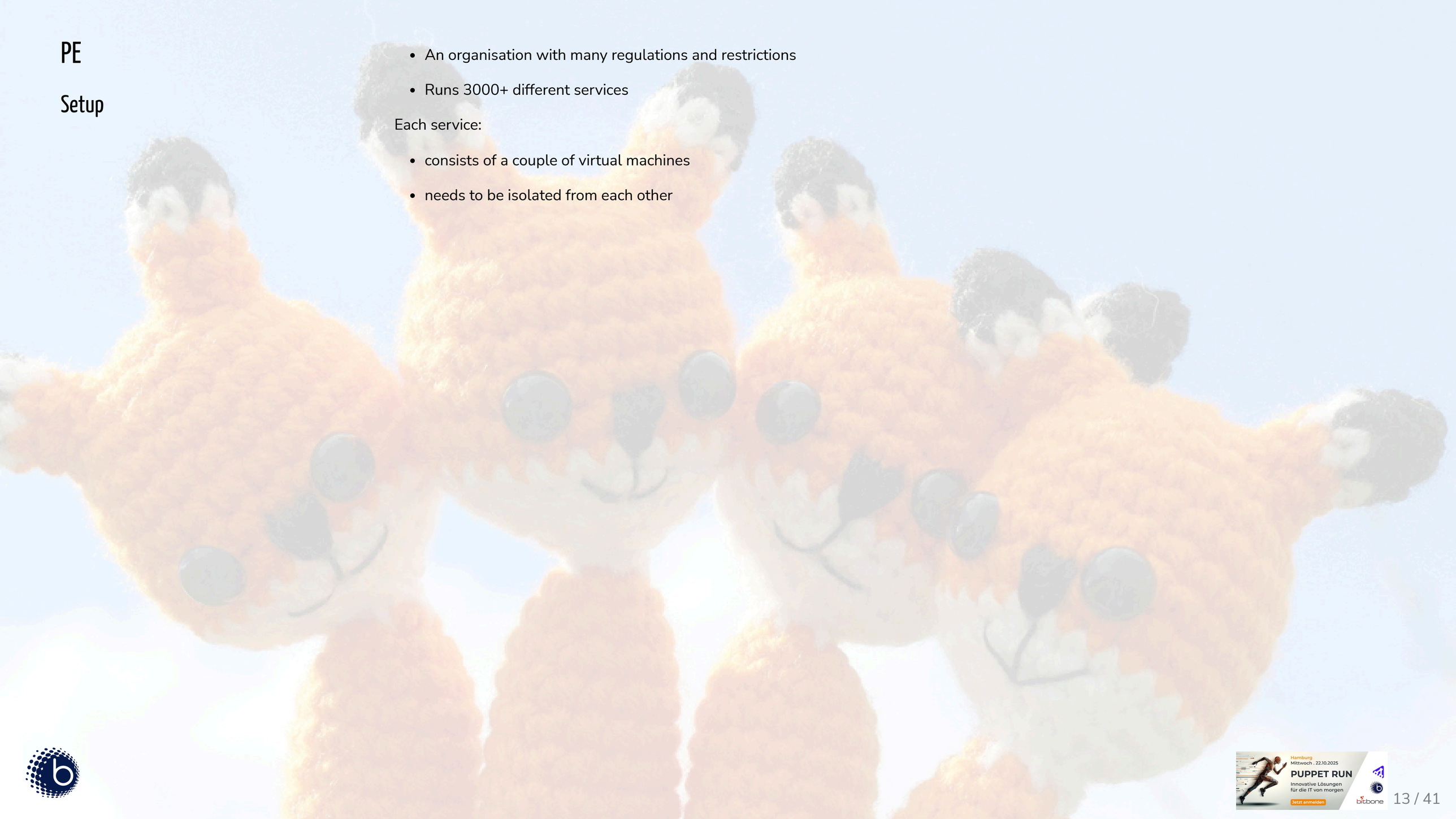
Each service:

- consists of a couple of virtual machines
- needs to be isolated from each other



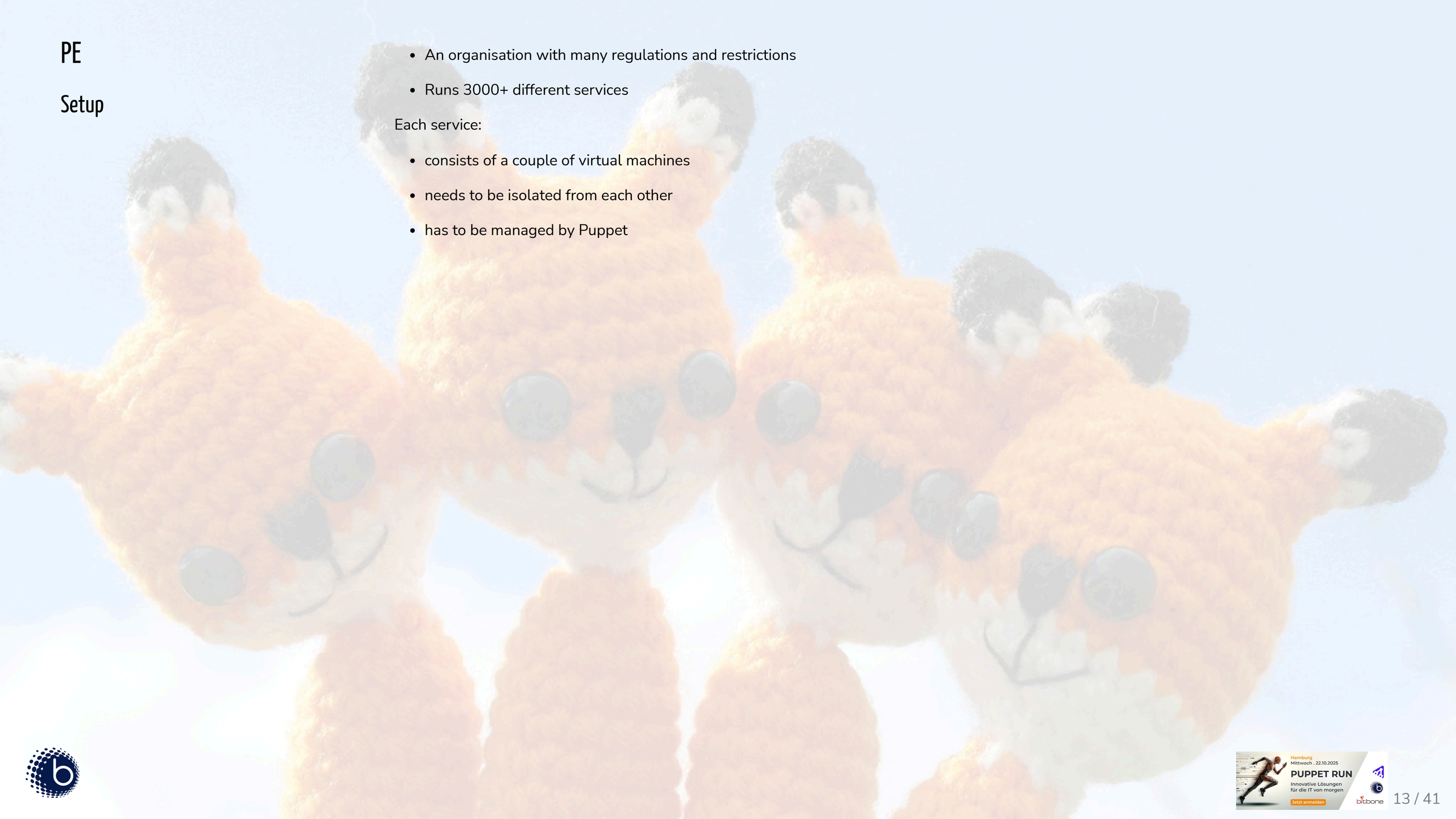
PE

Setup

- An organisation with many regulations and restrictions
- Runs 3000+ different services

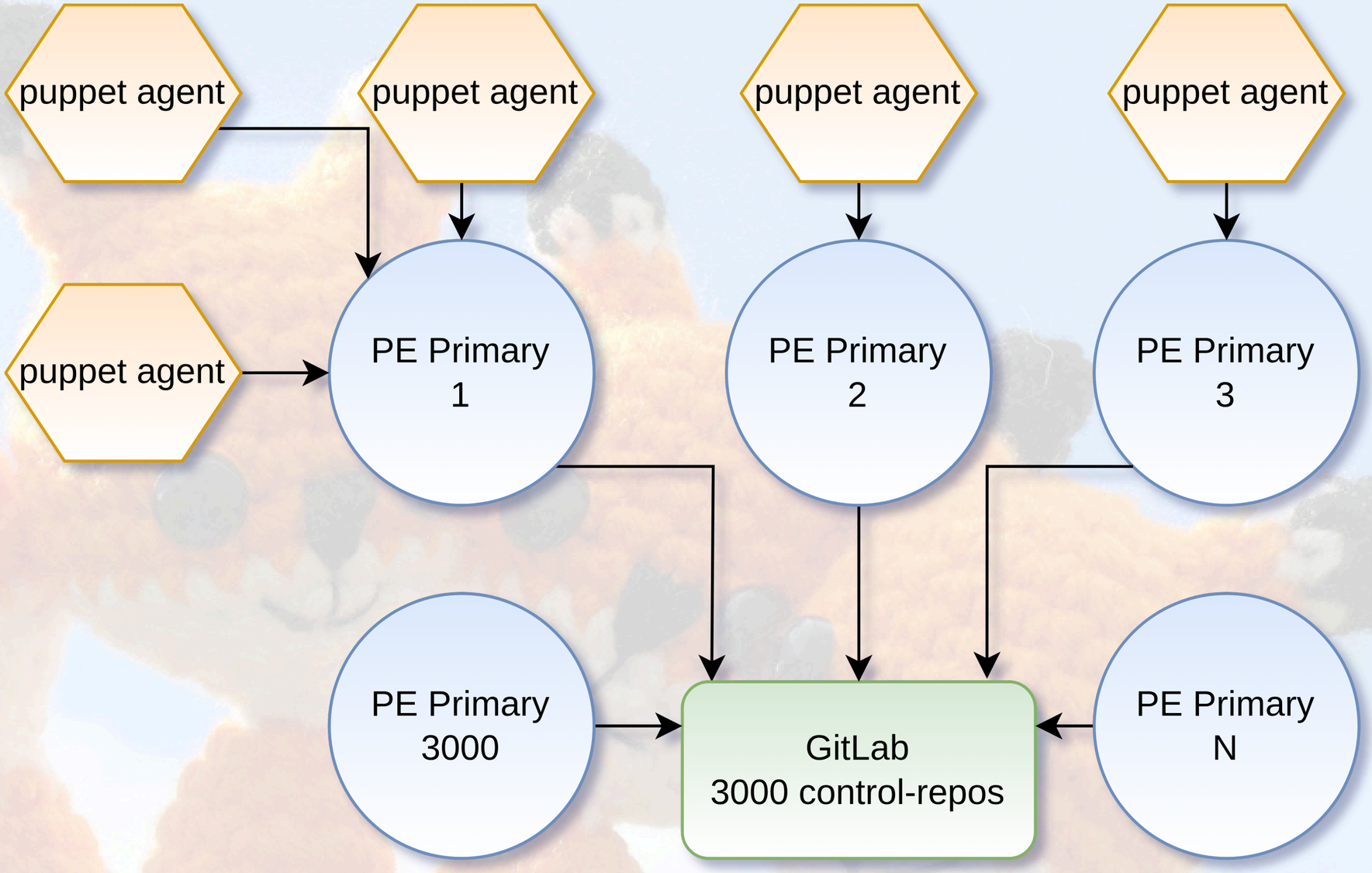
Each service:

- consists of a couple of virtual machines
- needs to be isolated from each other
- has to be managed by Puppet



PE

Setup



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PE

Setup

- Central GitLab (with geonodes)
  - contains all puppet modules
  - contains 3000+ control repos
- 3000+ individual primaries
- 5-200 agents per primary

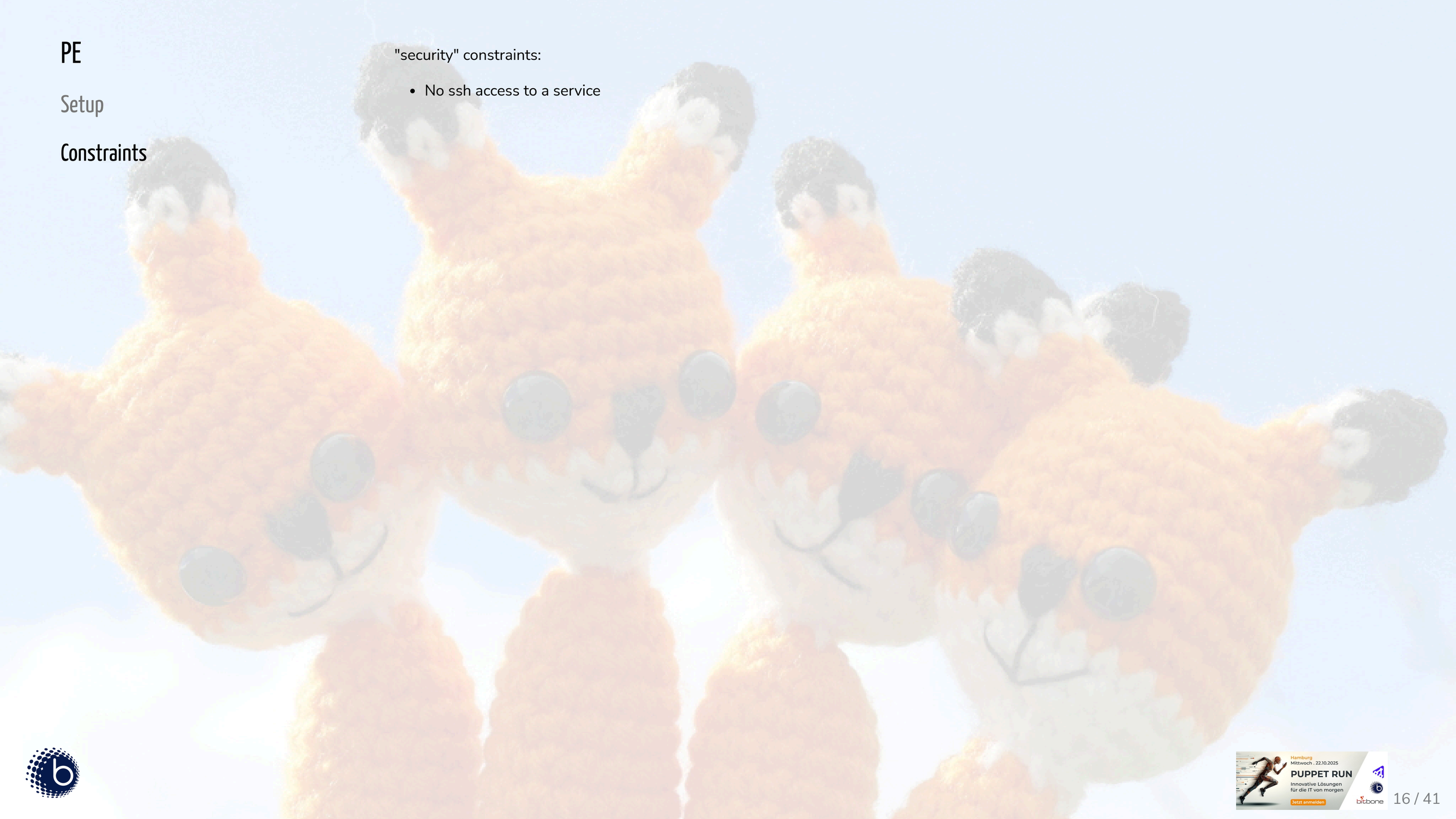
PE

Setup

Constraints

"security" constraints:

- No ssh access to a service



PE

Setup

Constraints

"security" constraints:

- No ssh access to a service
  - The PE APIs are available

PE

Setup

Constraints

"security" constraints:

- No ssh access to a service
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- No code changes for running services allowed
  - Architects wanted "immutable" services

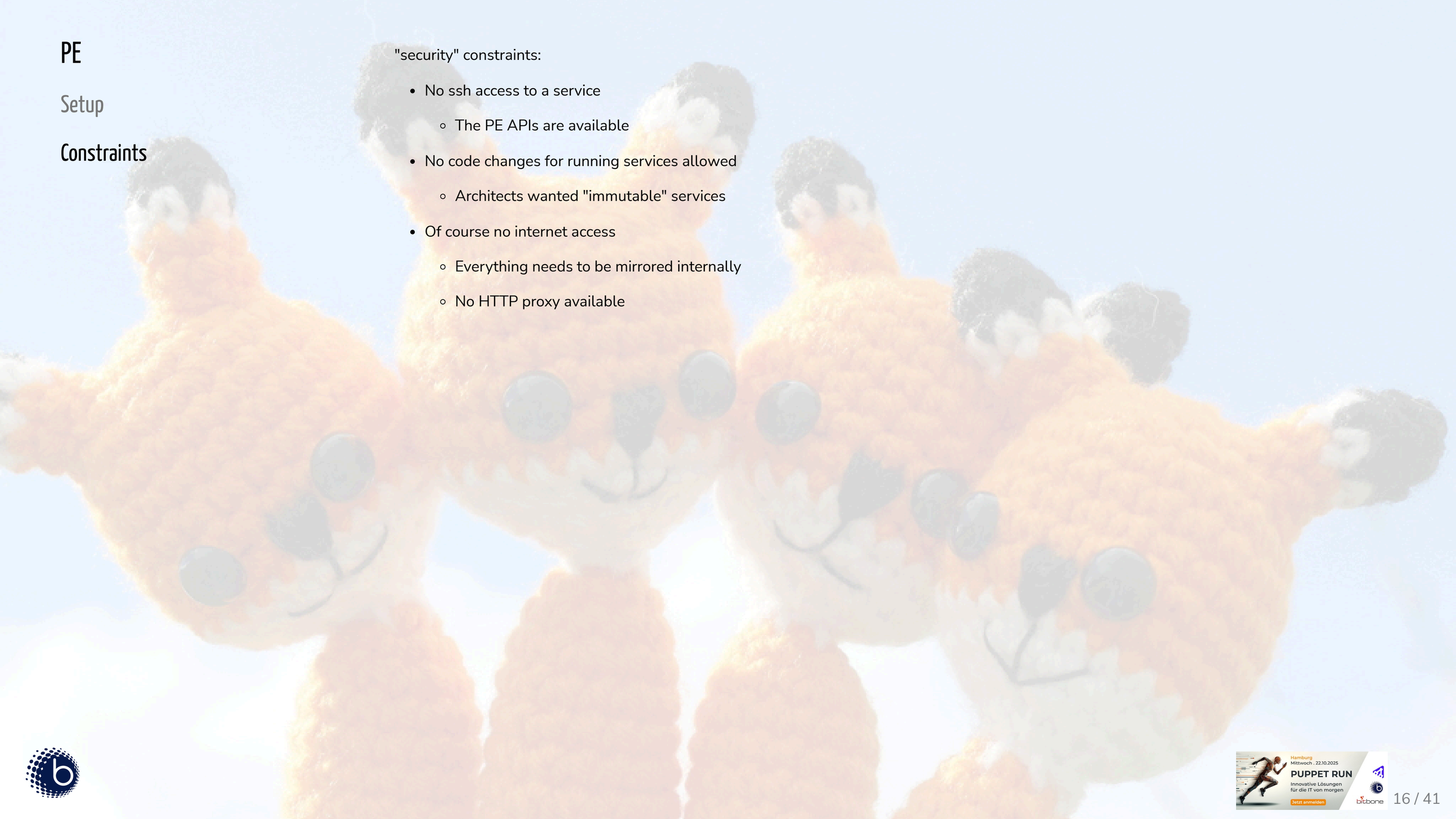
PE

Setup

Constraints

"security" constraints:

- No ssh access to a service
  - The PE APIs are available
- No code changes for running services allowed
  - Architects wanted "immutable" services
- Of course no internet access
  - Everything needs to be mirrored internally
  - No HTTP proxy available



PE

Setup

Constraints

Job

- Update 3000+ PE 2019 (Puppet 6) & PE 2021 (Puppet 7) services to PE 2023 (Puppet 8)

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PE

Setup

Constraints

Job

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- Don't use ssh

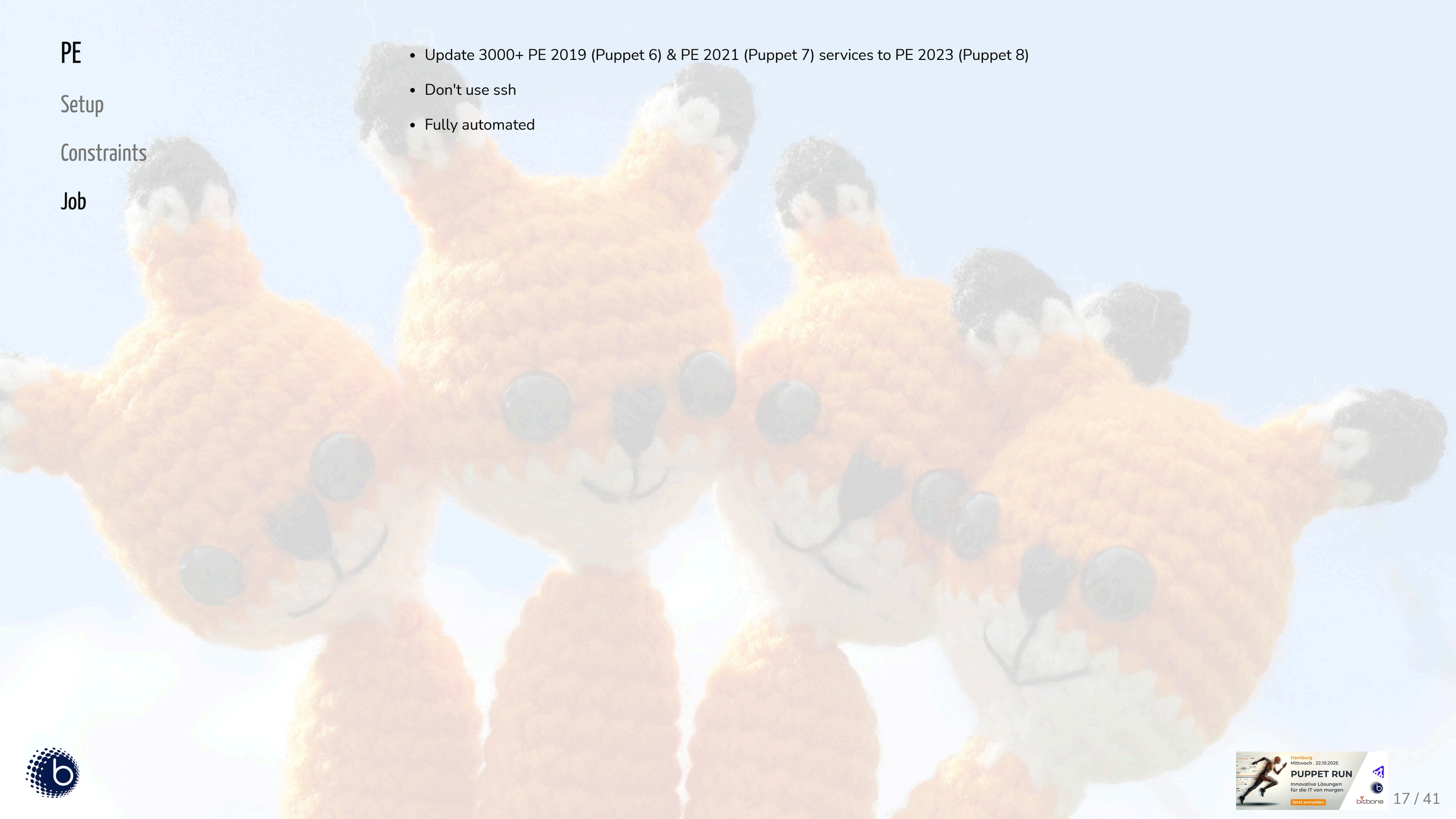
PE

Setup

Constraints

Job

- Update 3000+ PE 2019 (Puppet 6) & PE 2021 (Puppet 7) services to PE 2023 (Puppet 8)
- Don't use ssh
- Fully automated



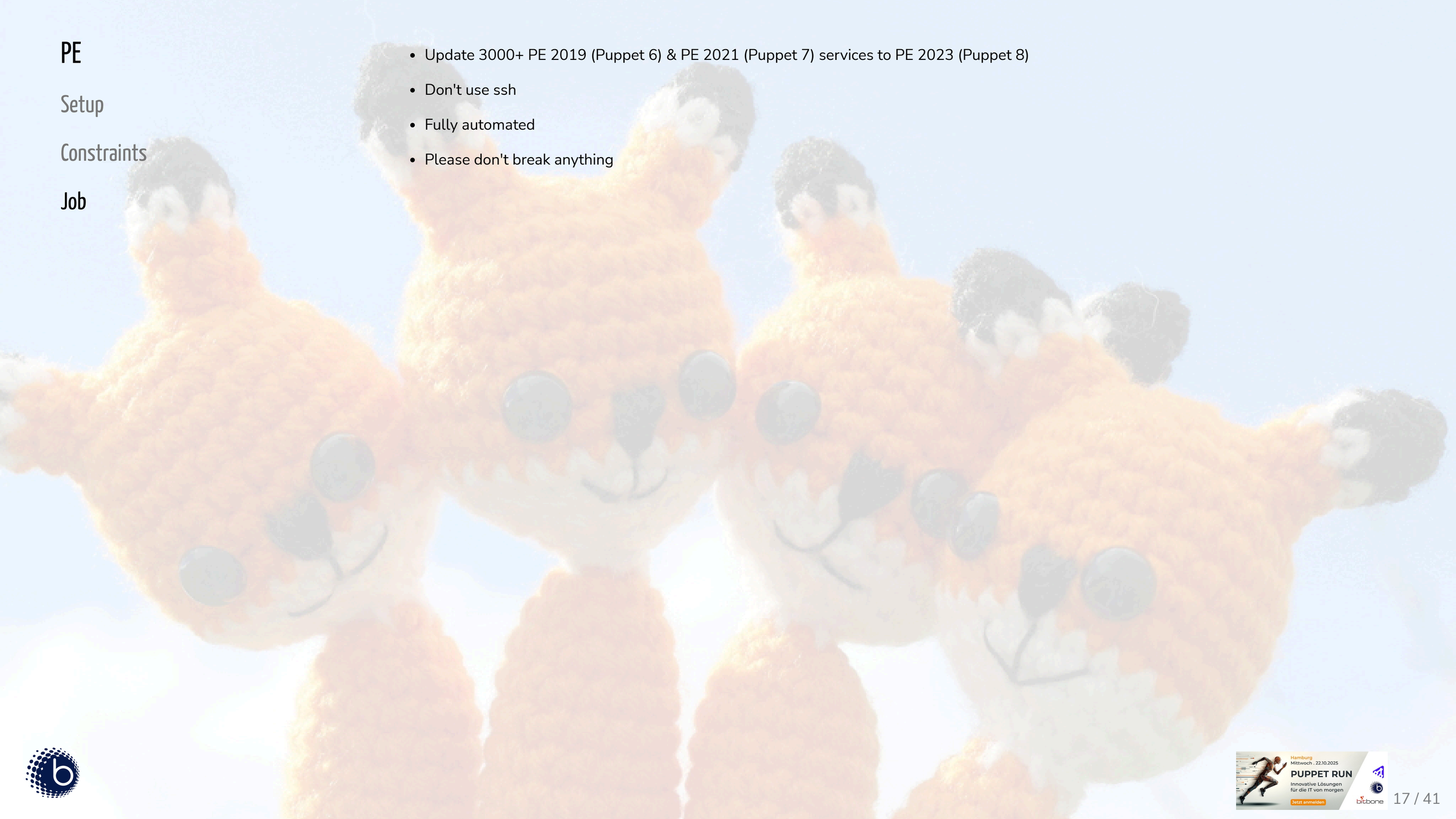
PE

Setup

Constraints

Job

- Update 3000+ PE 2019 (Puppet 6) & PE 2021 (Puppet 7) services to PE 2023 (Puppet 8)
- Don't use ssh
- Fully automated
- Please don't break anything



How you are supposed to Upgrade PE

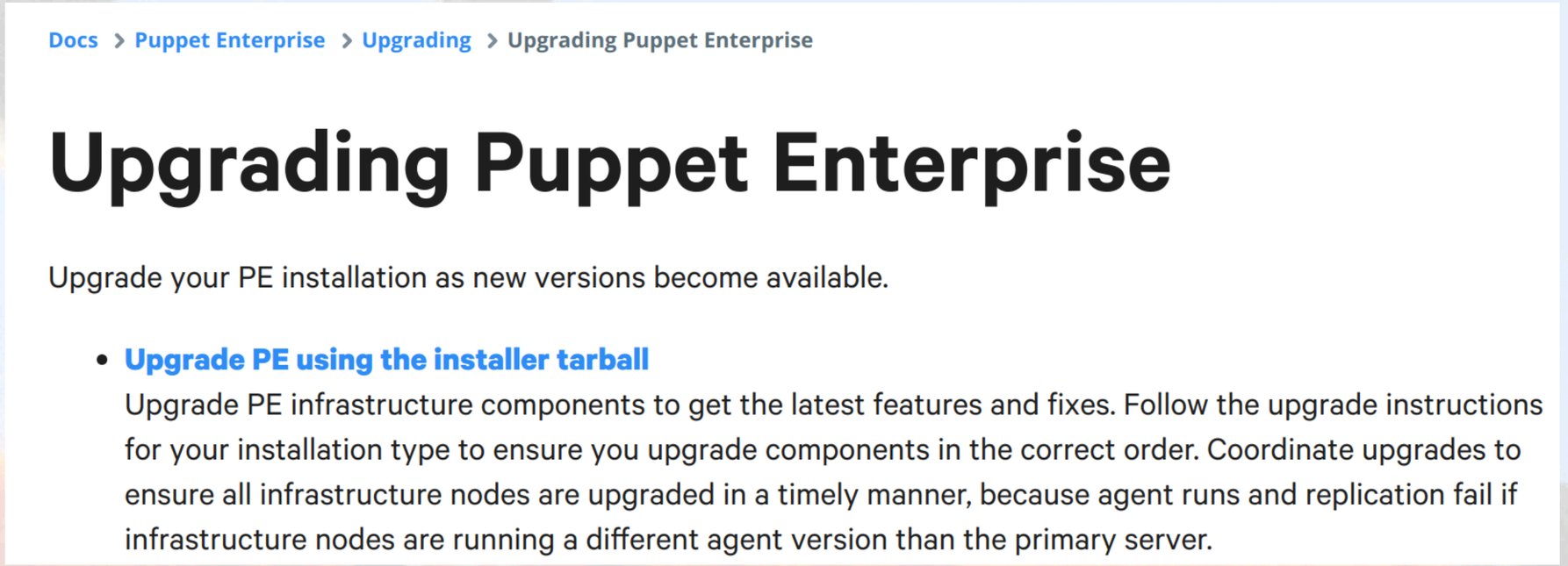
Docs > Puppet Enterprise > Upgrading > Upgrading Puppet Enterprise

Upgrading Puppet Enterprise

Upgrade your PE installation as new versions become available.

- **Upgrade PE using the installer tarball**
  Upgrade PE infrastructure components to get the latest features and fixes. Follow the upgrade instructions for your installation type to ensure you upgrade components in the correct order. Coordinate upgrades to ensure all infrastructure nodes are upgraded in a timely manner, because agent runs and replication fail if infrastructure nodes are running a different agent version than the primary server.

How you are supposed to Upgrade PE



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- TL;DR: "ssh to the Primary and download a tarball"

What's in the tarball?

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- one package contains puppet modules

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  - PE version specific
  - OS specific
- contains a yum repo with some rpms and a long bash script
- one package contains puppet modules
- bash script install the rpms & runs puppet apply

PE

Setup

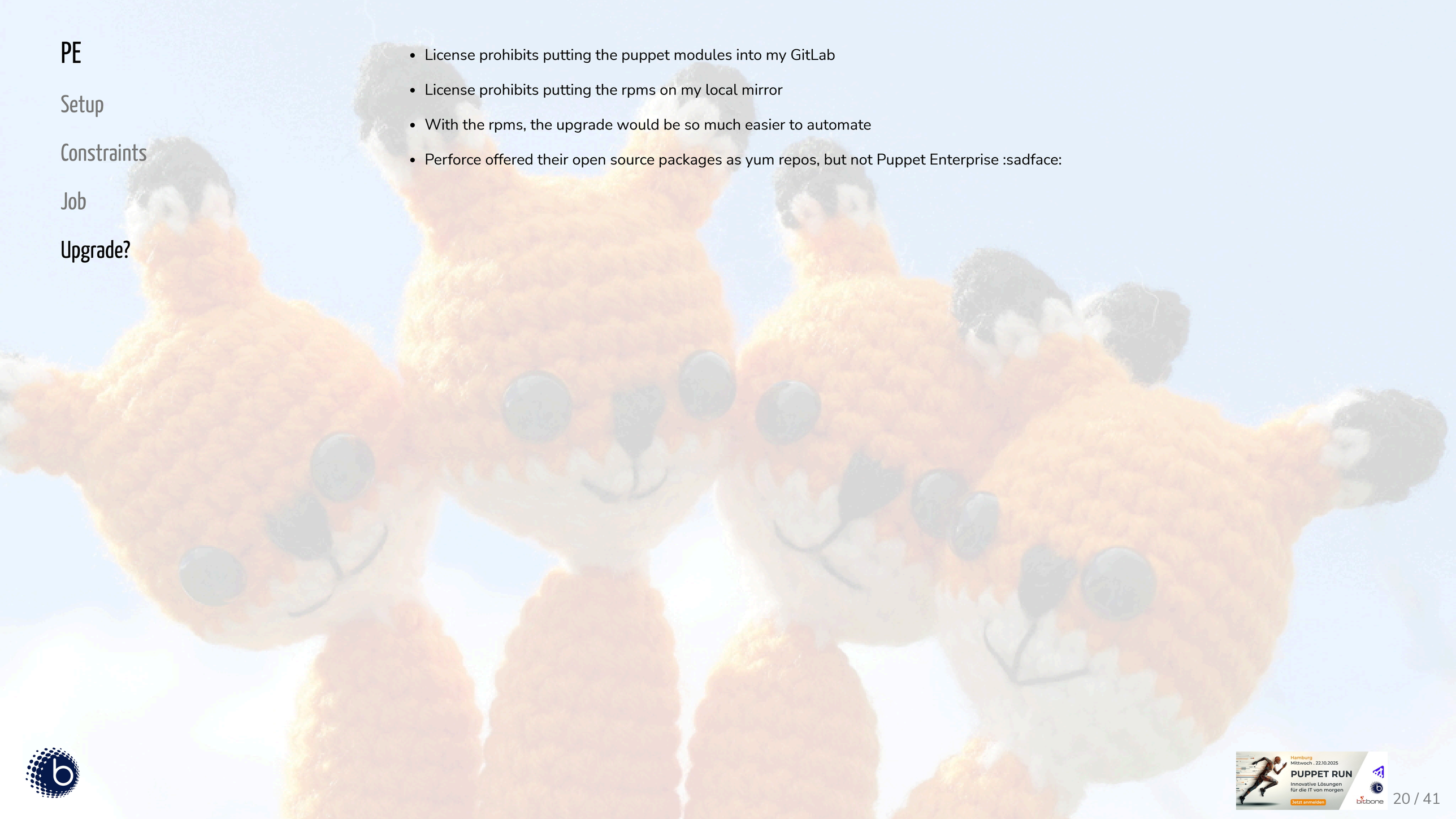
Constraints

Job

Upgrade?

- License prohibits putting the puppet modules into my GitLab
- License prohibits putting the rpms on my local mirror

- License prohibits putting the puppet modules into my GitLab
- License prohibits putting the rpms on my local mirror
- With the rpms, the upgrade would be so much easier to automate
- Perforce offered their open source packages as yum repos, but not Puppet Enterprise :sadface:



Docs › Puppet Enterprise › Upgrading › Upgrading Puppet Enterprise

Upgrading Puppet Enterprise

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- **Upgrade PE using PIM**
  Puppet Installation Manager (PIM) supports the upgrading of Puppet Enterprise (PE) for all supported installation architectures. For an interactive experience, choose the guided upgrade process and follow the steps in your terminal. Alternatively, if you do not require guidance, you can run your upgrade from the PIM command line by passing a JSON file containing your installation parameters.

- https://www.puppet.com/docs/pe/latest/upgrading_pe.html
- PIM is a frontend around Bolt & puppetlabs-peadm

PE

Setup

Constraints

Job

Upgrade?

- PIM is a frontend around Bolt & puppetlabs-peadm
- PEADM: A module with tasks and plans to install/modify/upgrade PE

PE

Setup

Constraints

Job

Upgrade?

- PIM is a frontend around Bolt & puppetlabs-peadm
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- PEADM wraps the original installer tarball

PE

Setup

Constraints

Job

Upgrade?

- PIM is a frontend around Bolt & puppetlabs-peadm
- PEADM: A module with tasks and plans to install/modify/upgrade PE
- PEADM wraps the original installer tarball
- PEADM is compatible with PE 2019.8.1 and newer

PE installer

- We cannot run the installer directly, because we don't have ssh access

PE

Setup

Constraints

Job

Upgrade?

Upgrade!

- The Orchestrator has an API to start plans
- Can it upgrade itself?

PE

Setup

Constraints

Job

Upgrade?

Upgrade!

- The Orchestrator has an API to start plans
- Can it upgrade itself?
  - No

PE

Setup

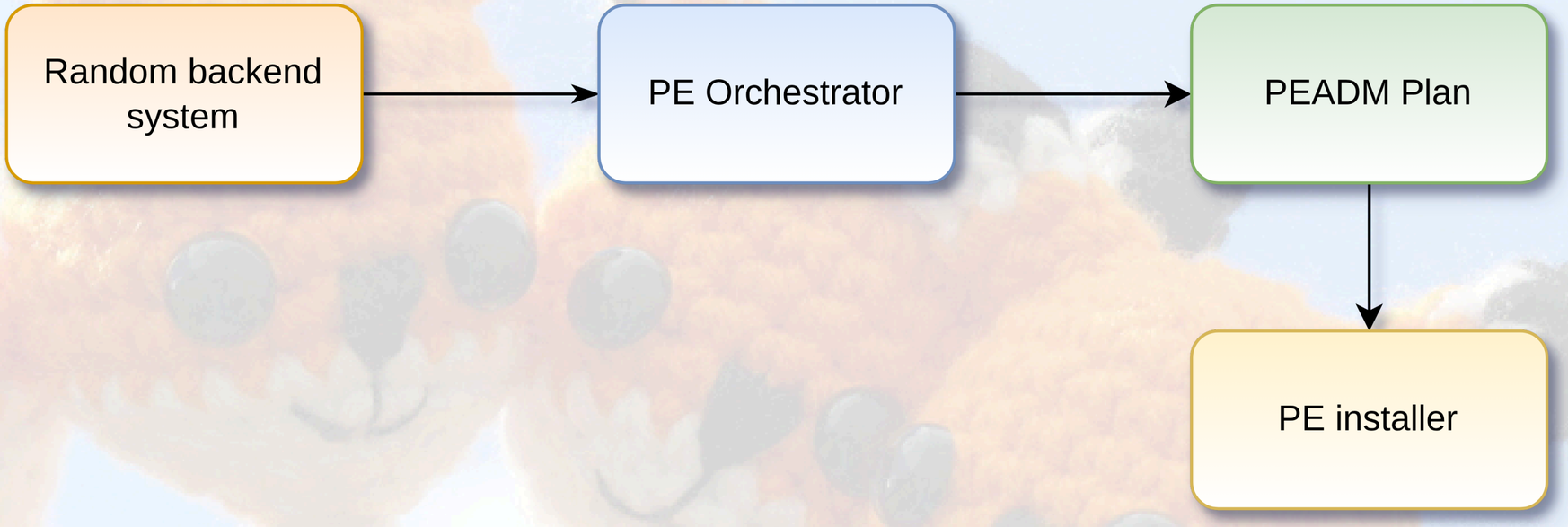
Constraints

Job

Upgrade?

Upgrade!

- The Orchestrator has an API to start plans
- Can it upgrade itself?
  - No
  - orchestrator rpm needs to be upgraded and service needs to be restarted
  - This will deadlock or abort the PEADM plan



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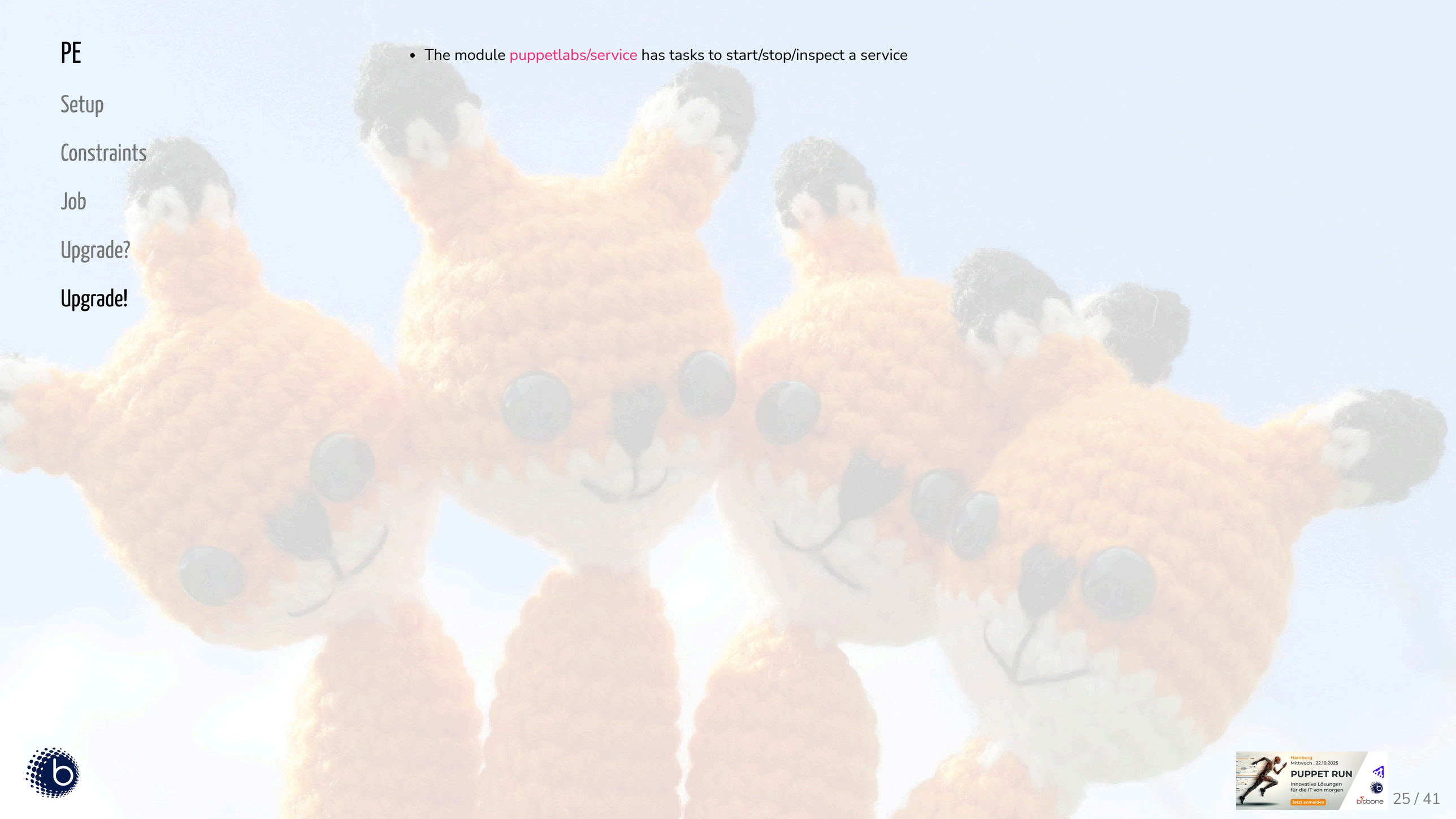
- The module puppetlabs/service has tasks to start/stop/inspect a service



PE

Setup

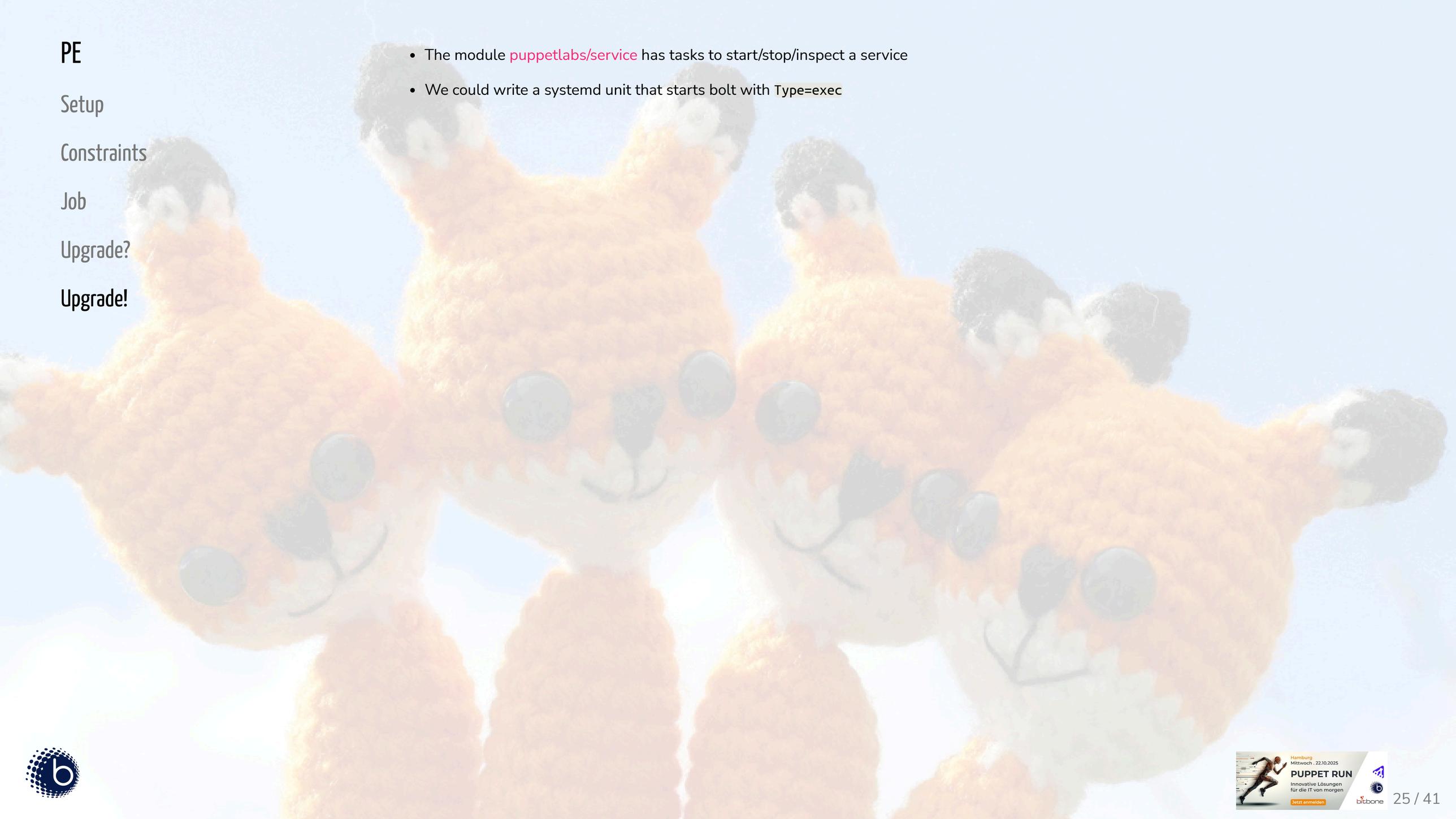
Constraints

Job

Upgrade?

Upgrade!

- The module puppetlabs/service has tasks to start/stop/inspect a service
- We could write a systemd unit that starts bolt with `Type=exec`



PE

Setup

Constraints

Job

Upgrade?

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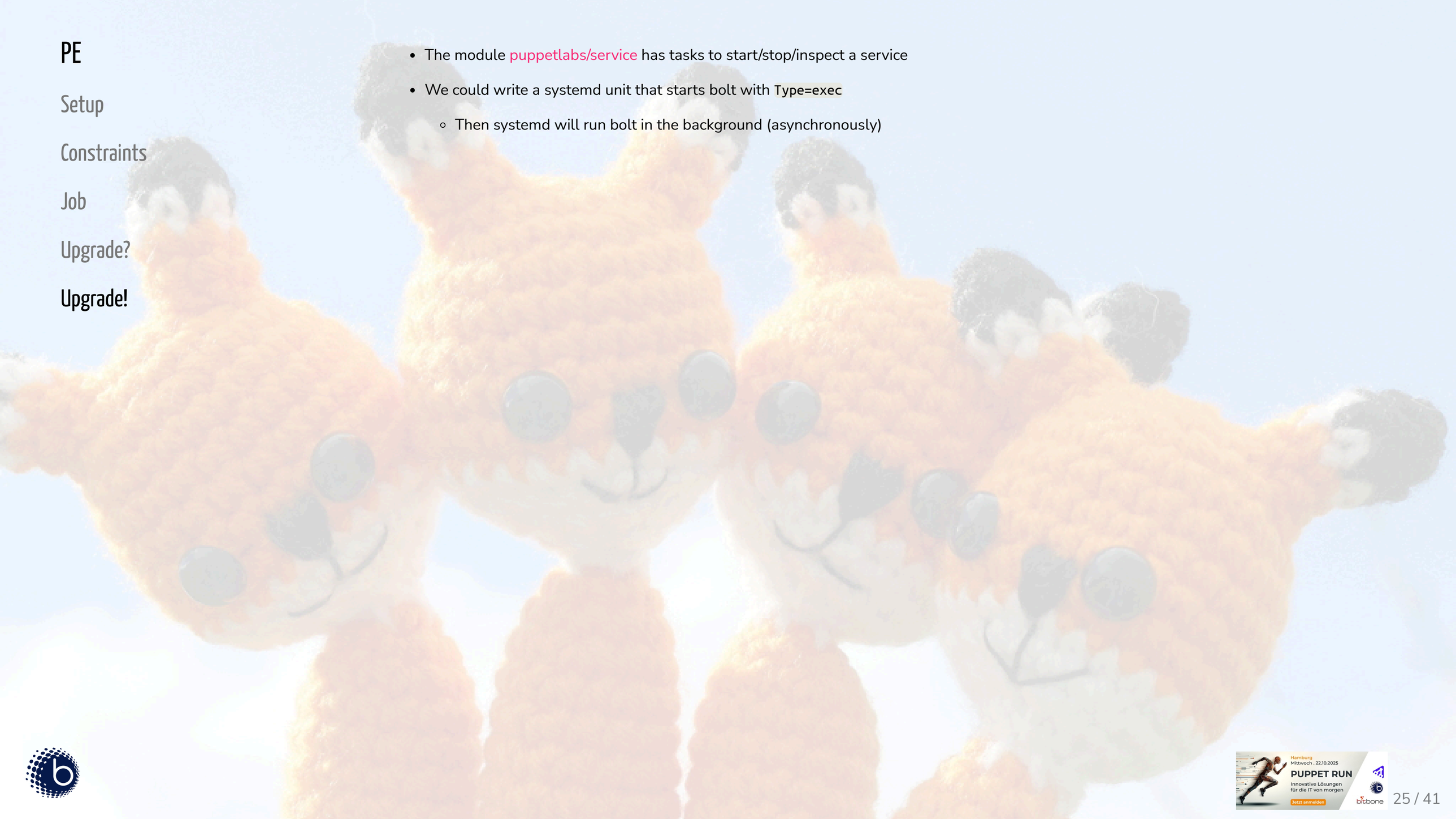

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```
# /etc/systemd/system/peadmmig@.service
# THIS FILE IS MANAGED BY PUPPET
[Unit]
Description=run bolt plans in project peadmmig

[Service]
Type=exec
ExecStart=/opt/puppetlabs/bin/bolt plan run %i --params @/opt/peadmmig/%i.json
User=peadmmig
Group=peadmmig
WorkingDirectory=/opt/peadmmig
# don't add RemainAfterExit,
# then we cannot track the state via puppet anymore after bolt started
```

- A template service unit contains a single `@` and accepts strings afterwards
- This allows us to pass plan names to our unit
- `systemctl {status,start} peadmmig@profiles::convert.service`

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- In May 2024 we asked if PE could provide bolt by default
  - Still no response. It was promised multiple times that someone will take a look at the issue

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- PE doesn't have bolt installed by default
- In May 2024 we asked if PE could provide bolt by default
  - Still no response. It was promised multiple times that someone will take a look at the issue
- Vox Pupuli now has a module to install bolt: forge.puppet/com/puppet/bolt
  - The module can create the systemd template service unit + all required configuration files

PE

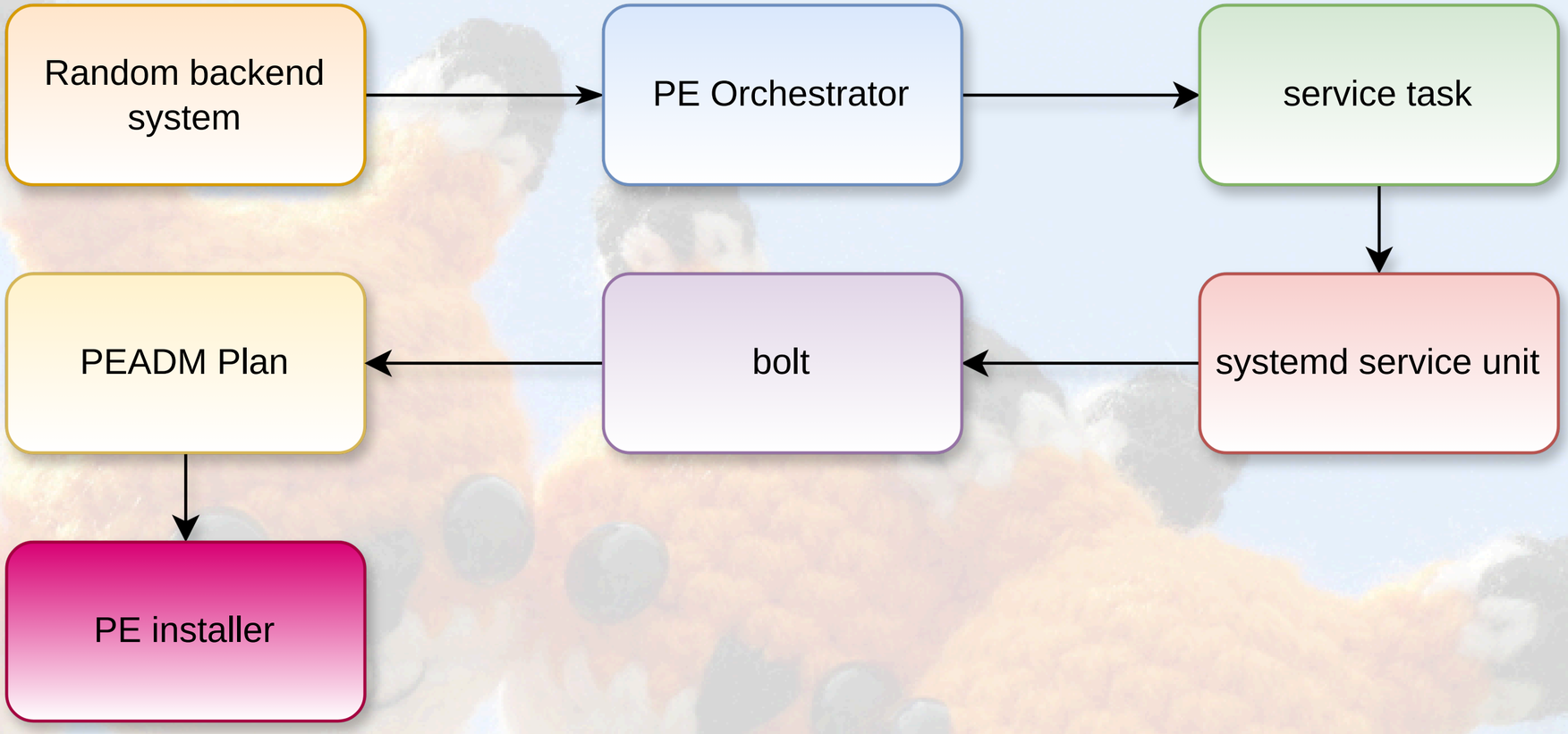
Setup

Constraints

Job

Upgrade?

Upgrade!



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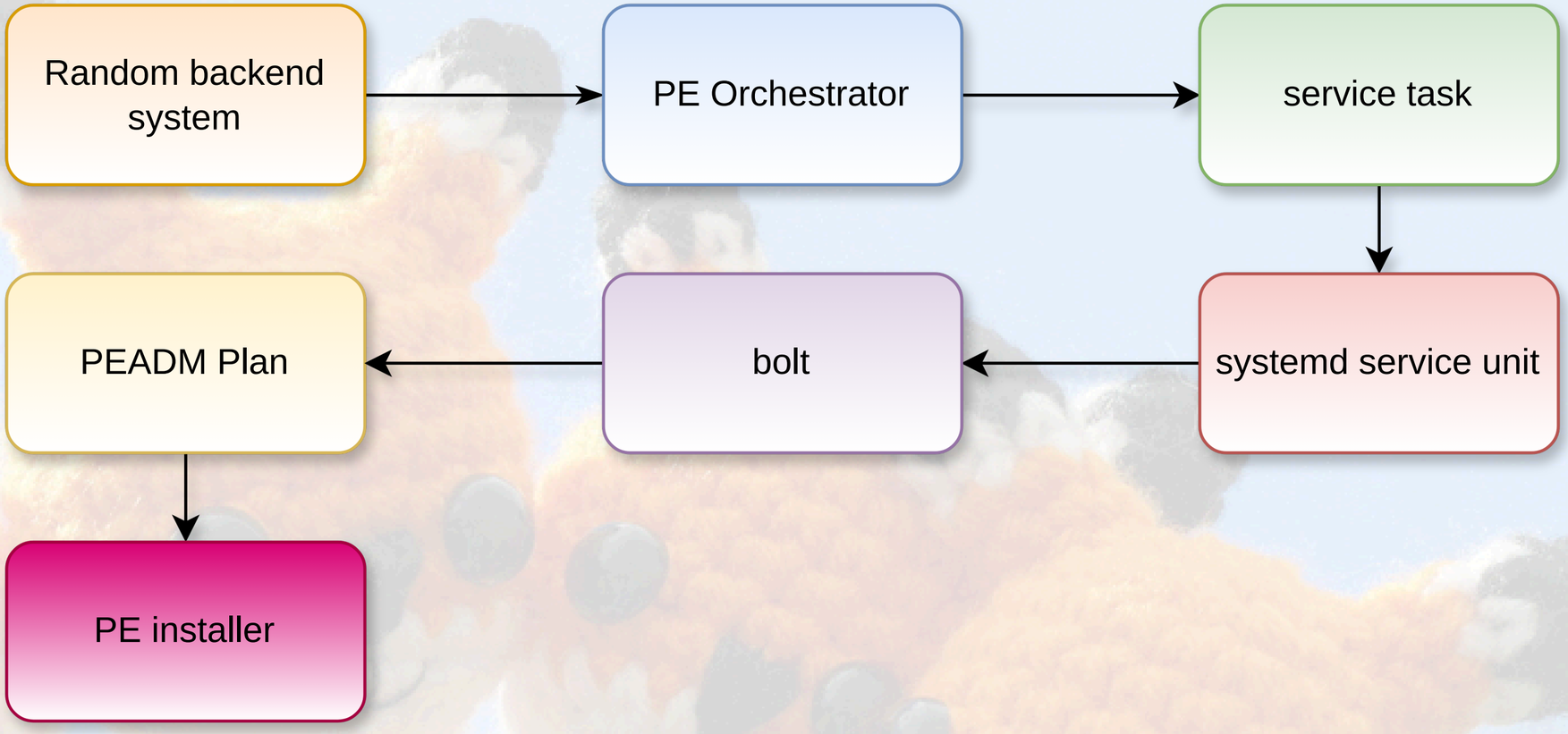

- During development, this worked surprisingly well

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PE

Setup

Constraints

Job

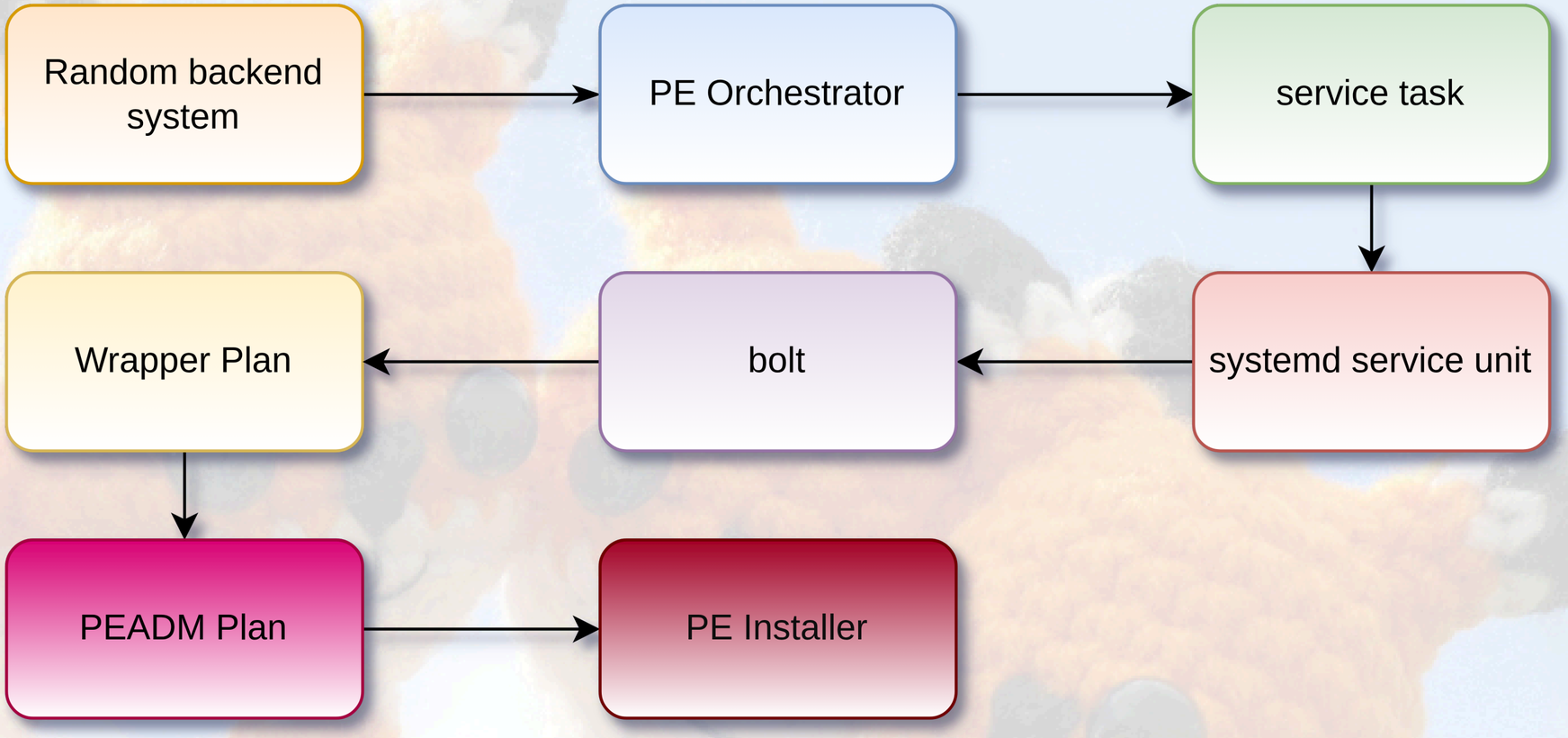
Upgrade?

Upgrade!

Deployment?

- We need our own plan that does some sanity/health checks
  - If everything is fine, our plan starts the peadm::upgrade plan

- We need our own plan that does some sanity/health checks
  - If everything is fine, our plan starts the peadm::upgrade plan



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PE

Setup

Constraints

Job

Upgrade?

Upgrade!

Deployment?

- We need to run peadm::convert before peadm::upgrade
  - This will replace the TLS certificate on your primary

PE

Setup

Constraints

Job

Upgrade?

Upgrade!

Deployment?

- We need to run peadm::convert before peadm::upgrade
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- We need to deploy our own plans, but code deployments aren't allowed

- We need to run peadm::convert before peadm::upgrade
  - This will replace the TLS certificate on your primary
- We need to deploy our own plans, but code deployments aren't allowed
- "No code deployments that might impact normal puppet agent operations"
- PE supports multiple control repositories
  - We can add another control repo, that only contains tasks/plan/modules for PE upgrades
  - No agent will make a puppet run in this environment

- PE has two ways to specify a control repo:
- A single control repo

```
puppet_enterprise::profile::master::r10k_remote: 'https://github.com/testcontrolrepo.git'
```

- N control repos

```
puppet_enterprise::master::code_manager::sources:
  foo:
    remote: 'https://github.com/bastelfreak/testcontrolrepo.git'
    prefix: false
  baz:
    remote: 'https://github.com/voxpupuli/controlrepo'
    prefix: true
```

PE

Setup

Constraints

Job

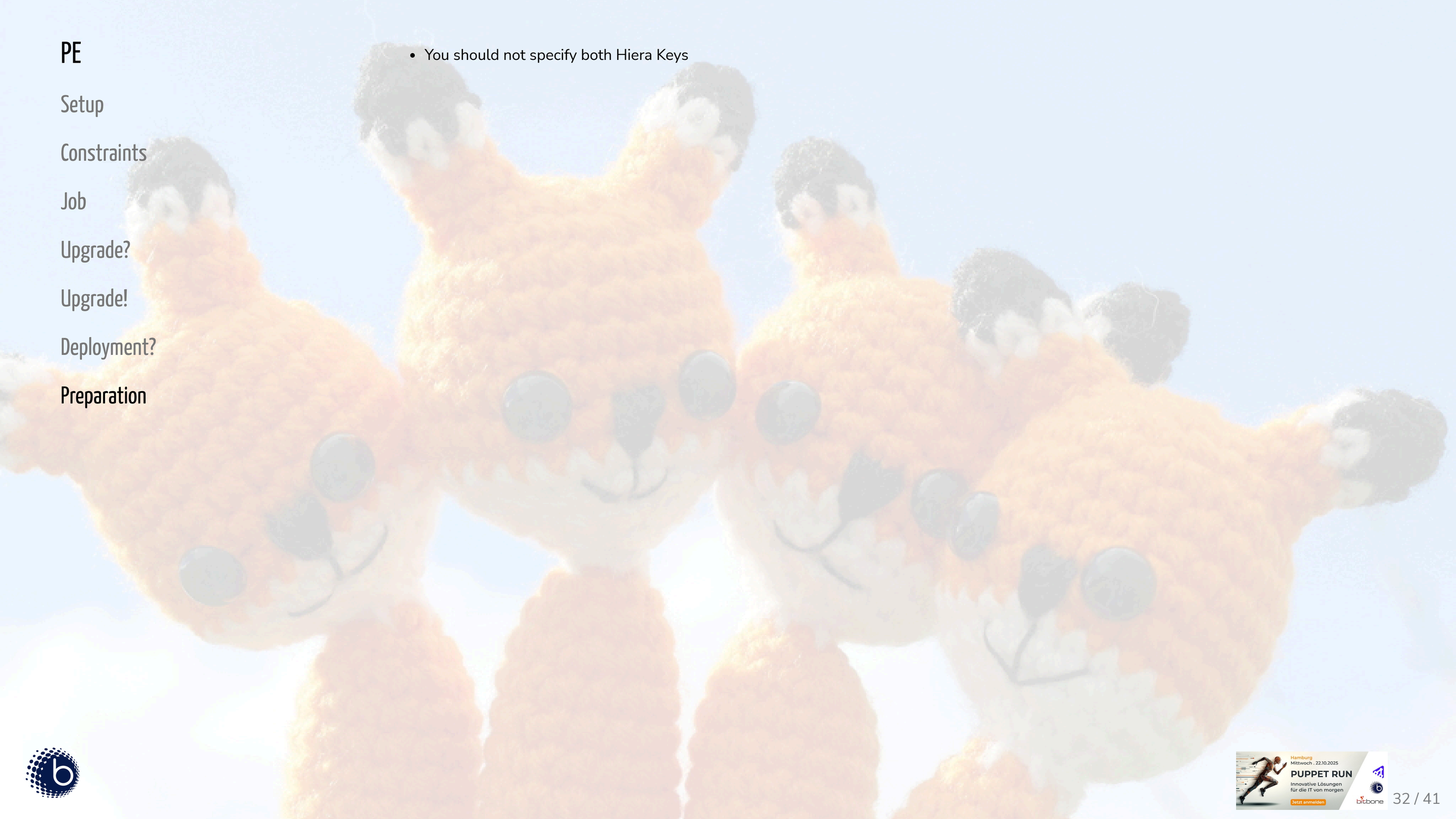
Upgrade?

Upgrade!

Deployment?

Preparation

- You should not specify both Hiera Keys



PE

Setup

Constraints

Job

Upgrade?

Upgrade!

Deployment?

Preparation

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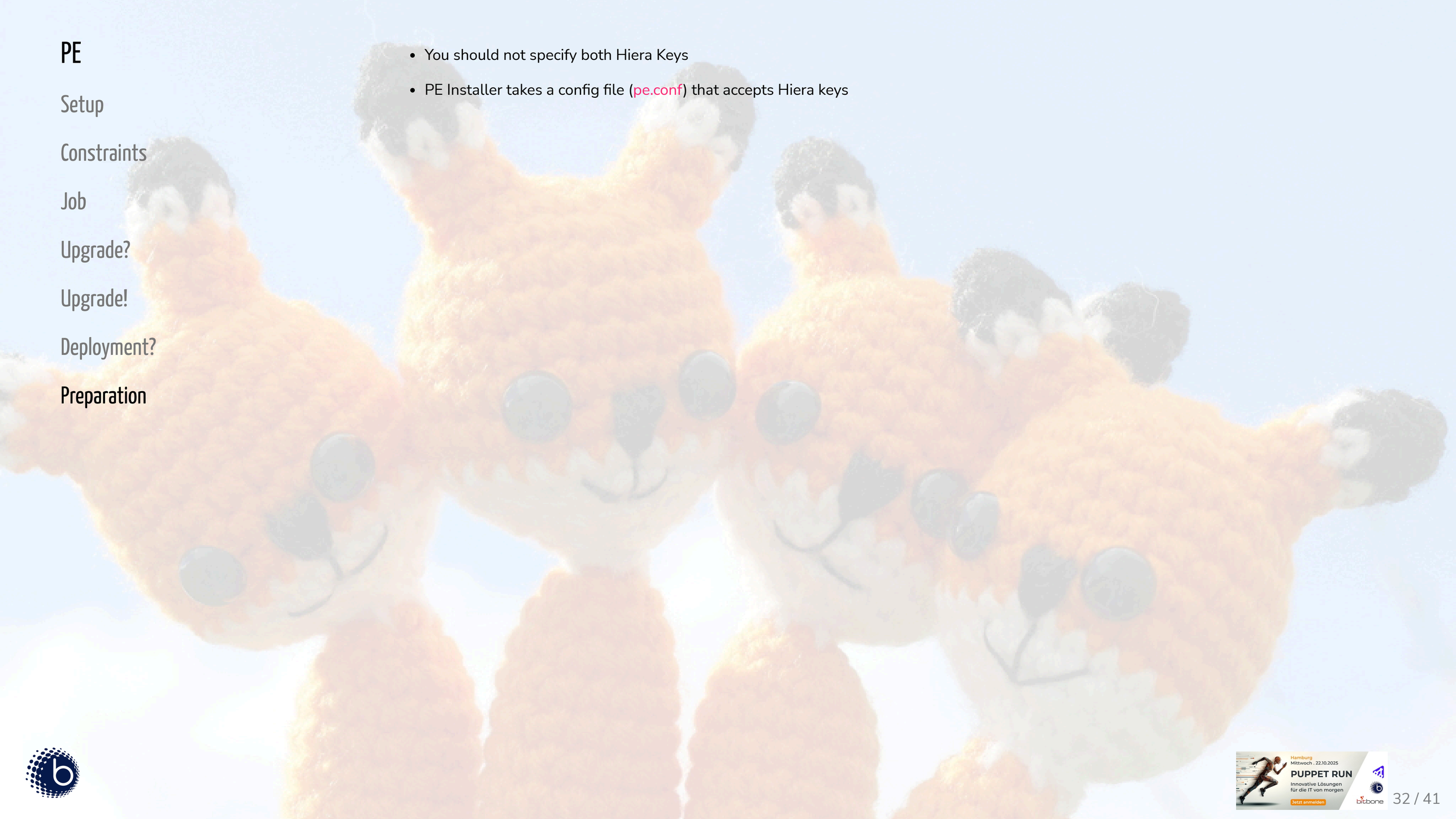
- PE Installer takes a config file (pe.conf) that accepts Hiera keys



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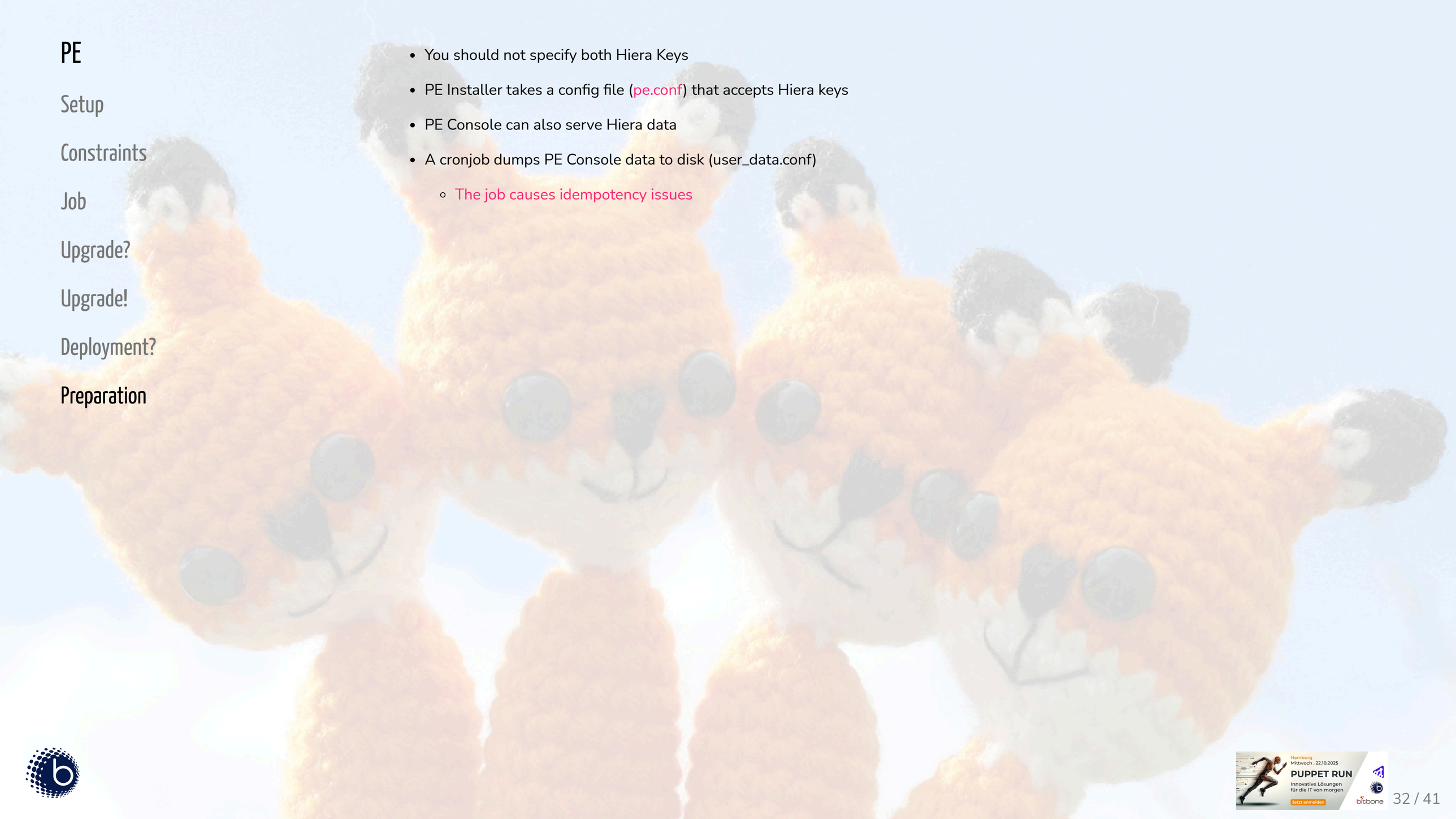

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- pe.conf and user_data.conf use HOCON format
- Puppet core/stdlib have no function to write HOCON

PE

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Constraints

Job

Upgrade?

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Preparation

- Every deployed service has their own control repo branch
  - No agents runs in a production environment

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PE

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Upgrade!

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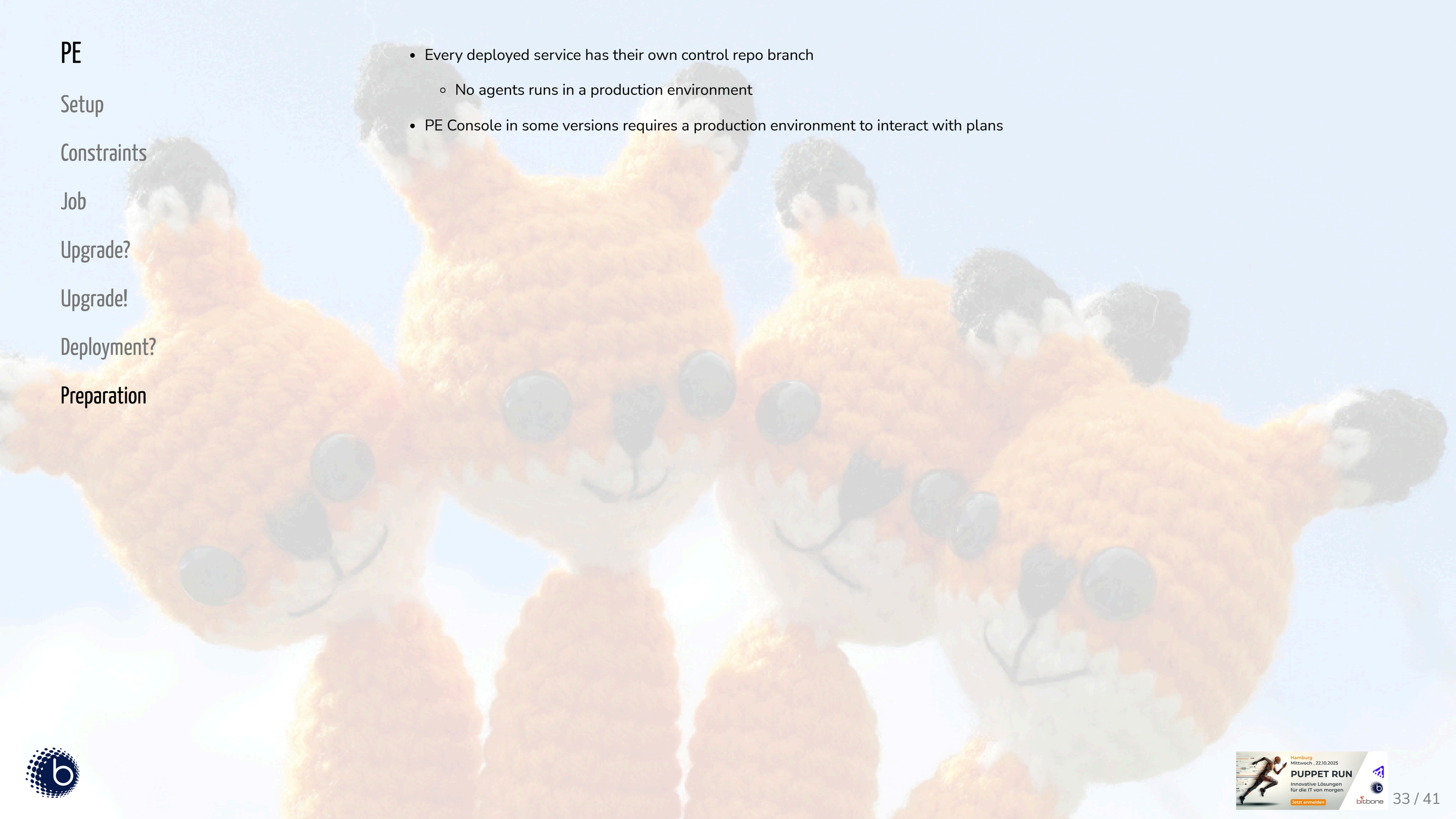
- PE Console in some versions requires a production environment to interact with plans



PE

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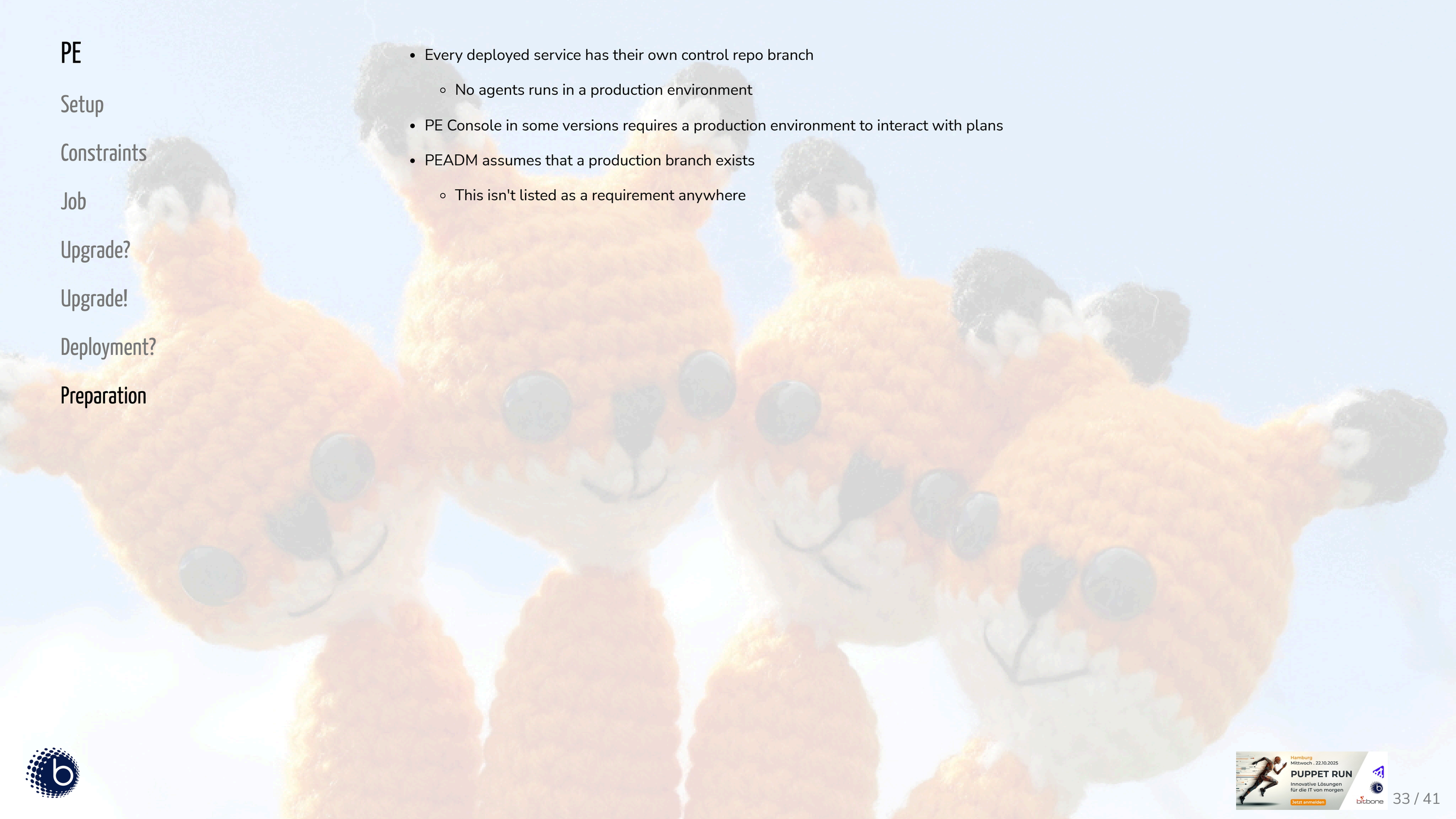

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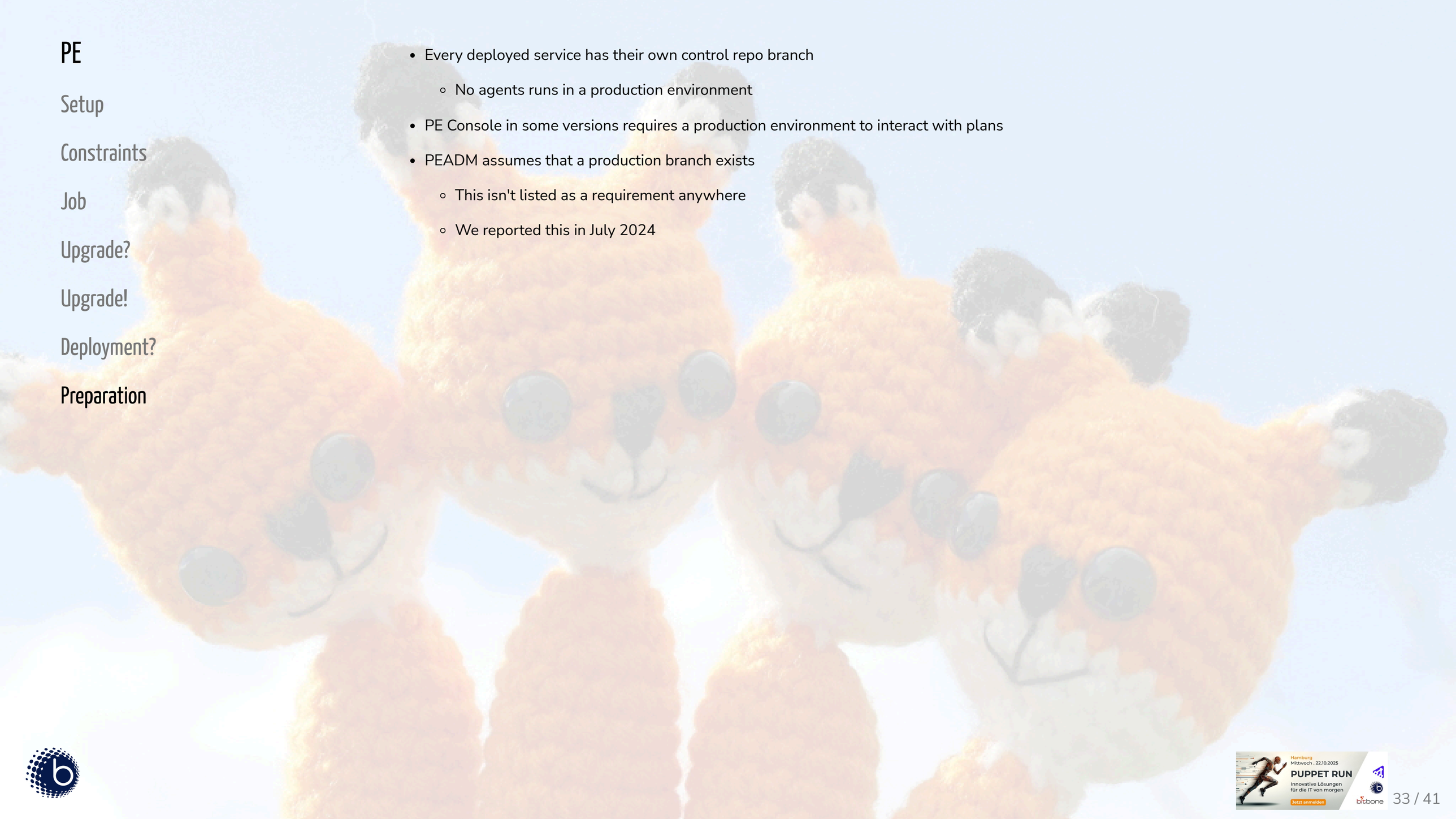

- Required Hiera keys when the Primary isn't running in production

```
pe_install::install::classification::pe_node_group_environment: 'foo'
puppet_enterprise::master::recover_configuration::pe_environment: 'foo'
```

- Only required for inplace updates
- puppet.com/docs/pe/latest/upgrading_pe.html

PE

Setup

Constraints

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Upgrade?

Upgrade!

Deployment?

Preparation

- Puppet agent sometimes starts a run in production environment
- ENC tells the agent the correct environment
- puppet agent starts again

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```
ini_setting { 'puppet.conf environment':
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  path    => '/etc/puppetlabs/puppet/puppet.conf',
  section => 'agent',
  setting => 'environment',
  value   => $env,
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```
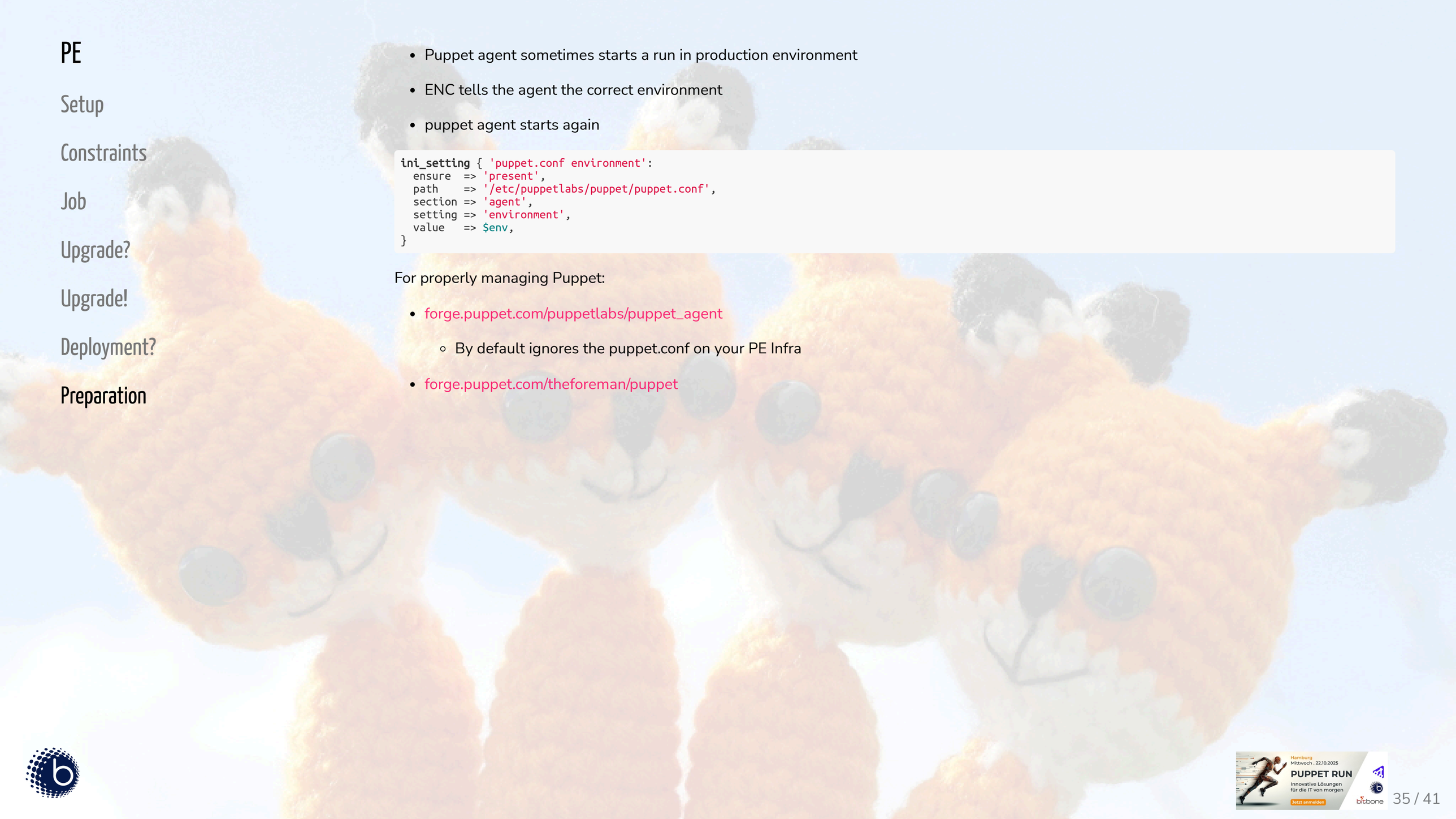

For properly managing Puppet:

- forge.puppet.com/puppetlabs/puppet_agent
  - By default ignores the puppet.conf on your PE Infra
- forge.puppet.com/theforeman/puppet



PE

Setup

Constraints

Job

Upgrade?

Upgrade!

Deployment?

Preparation

Is a service in a healthy state so we can upgrade PE?

- Just one Primary, no other PE infra nodes?
- All agents delivered a report in the last 30 minutes?
- No failed resources, no cached catalog, no skipped resources?
- Same puppet agent version everywhere?

Is a service in a healthy state so we can upgrade PE?

- Just one Primary, no other PE infra nodes?
- All agents delivered a report in the last 30 minutes?
- No failed resources, no cached catalog, no skipped resources?
- Same puppet agent version everywhere?
- puppetlabs/pe_status_check contains plans to get those information
  - We contributed some of them

- Let us glue everything together!

```
plan profiles::convert (
  Peadm::SingleTargetSpec $primary_host,
) {
  run_plan('profiles::subplans::precheck', { 'primary_host' => $primary_host })

  # peadm::convert does two more sanity checks:
  #   - do we have the correct bolt version
  #   - are all nodes reachable
  run_plan('peadm::convert', { 'primary_host' => $primary_host, '_run_as' => 'root' })

  # peadm::upgrade doesn't do a final puppet run without changed resources
  # To have a clean report, we trigger a puppet run here
  # we  run it twice, in case we've a raise condition with an already running puppet agent
  $params = {'_run_as' => 'root', '_catch_errors' => true }
  $result = run_task('peadm::puppet_runonce', $primary_host, $params)
  # ok is true if the task was successful on all targets
  unless $result.ok {
    out::message("Final peadm::puppet_runonce failed with: ${result}")
    out::message('Trying another puppet run')
    run_task('peadm::puppet_runonce', $primary_host, '_run_as' => 'root')
  }
}
```

Open Source plans we have:

- `convert` - does all the healthchecks & prepare steps & `peadm::convert`
- `upgrade` - accepts a PE version as parameter, does healthcheck and then upgrades
- `convertandupgradeto2021` - convert & upgrade to latest PE 2021
- `convertandupgradeto2023` - convert & upgrade to latest PE 2023
- `convertandupgradeto202386` - convert & upgrade to PE 20238.6

Open Source plans we have:

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- `convertandupgradeto202386` - convert & upgrade to PE 20238.6
- All of this is under GPL license at github.com/bastelfreak/testcontrolrepo
- Contains lots of sanity checks, tested in many many different scenarios

PE

Setup

Constraints

Job

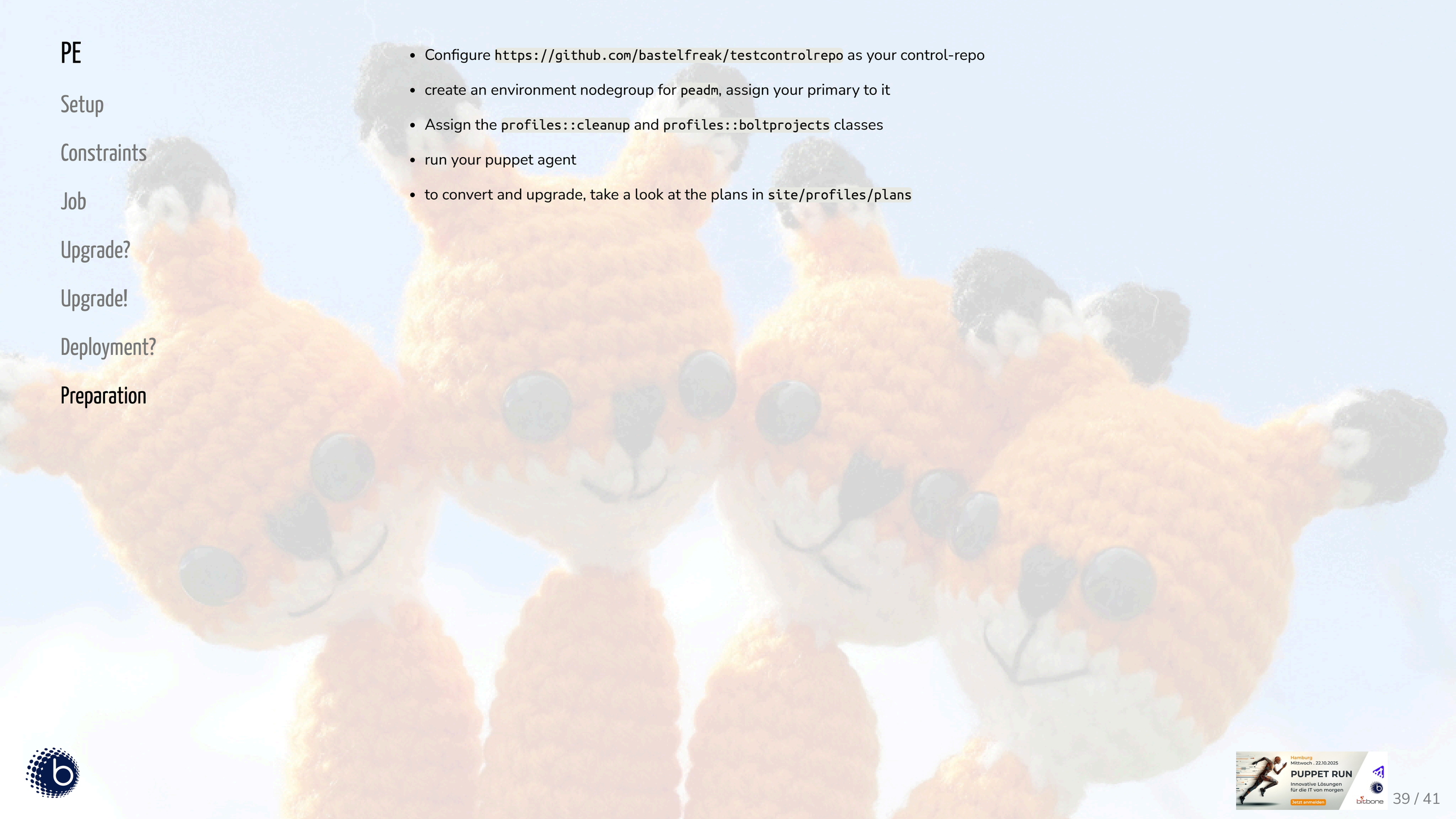
Upgrade?

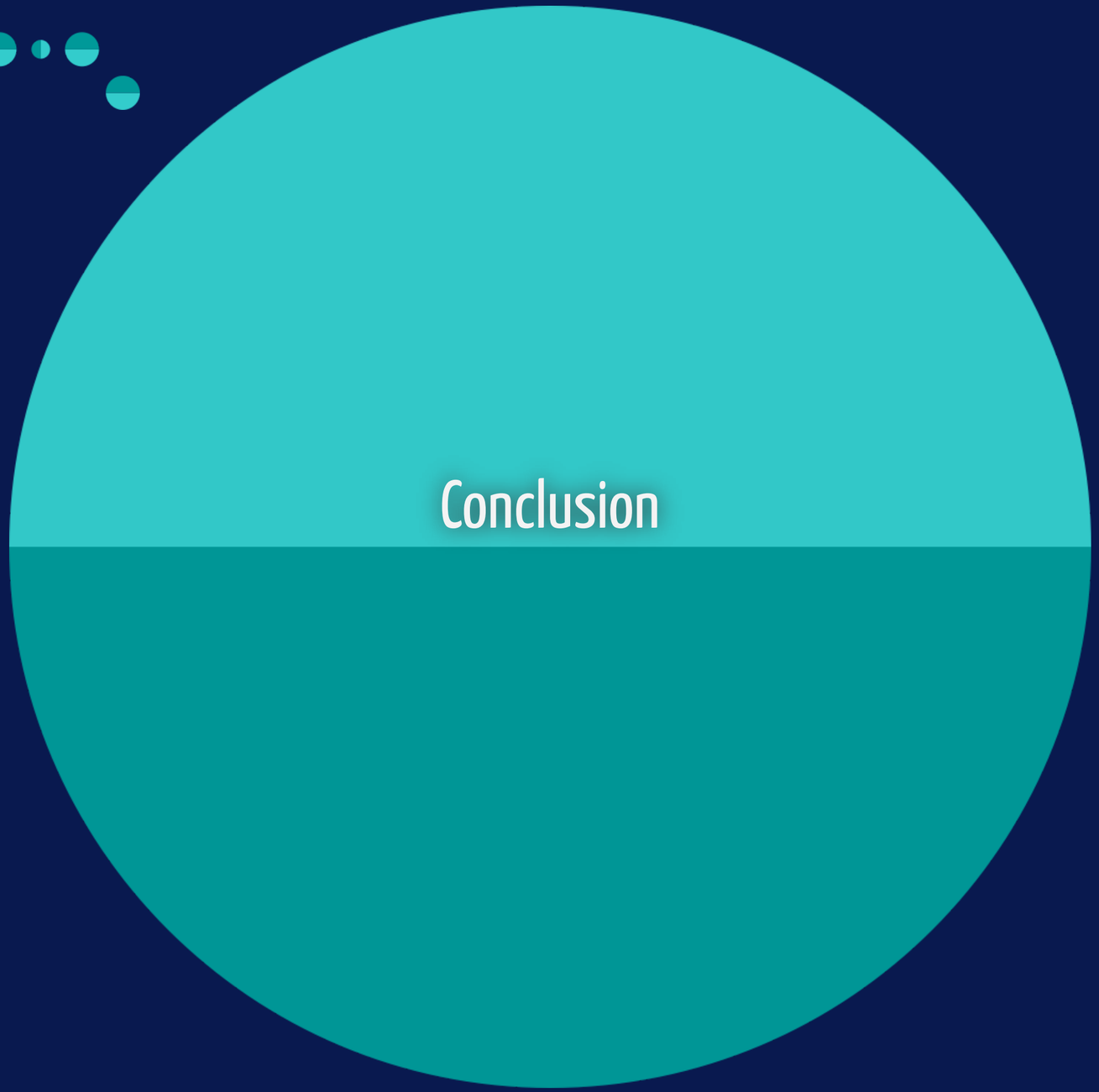
Upgrade!

Deployment?

Preparation

- Configure `https://github.com/bastelfreak/testcontrolrepo` as your control-repo
- create an environment nodegroup for `peadm`, assign your primary to it
- Assign the `profiles::cleanup` and `profiles::boltprojects` classes
- run your puppet agent
- to convert and upgrade, take a look at the plans in `site/profiles/plans`




Conclusion

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- You can do fully automated PE upgrades, without SSH access

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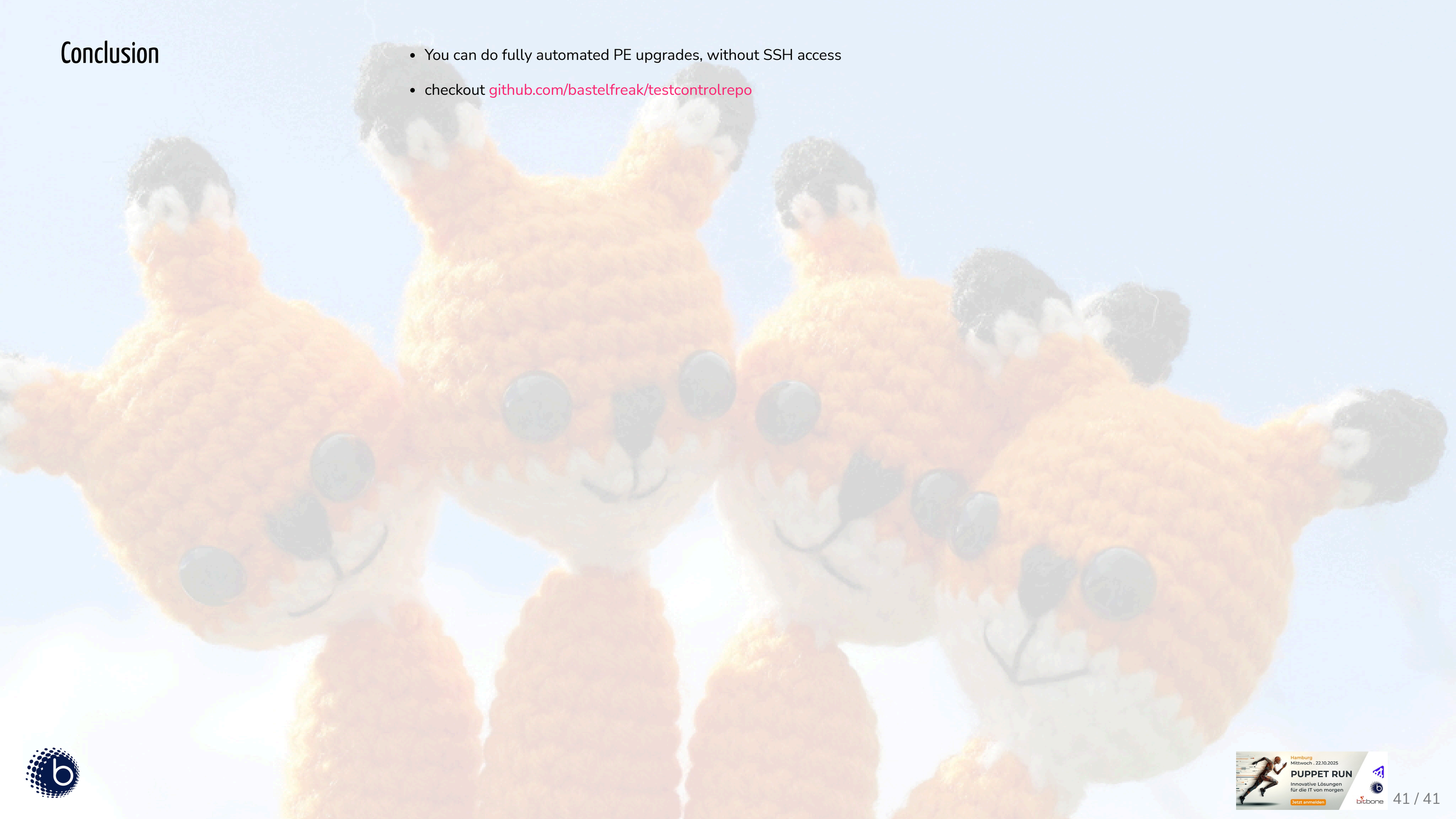
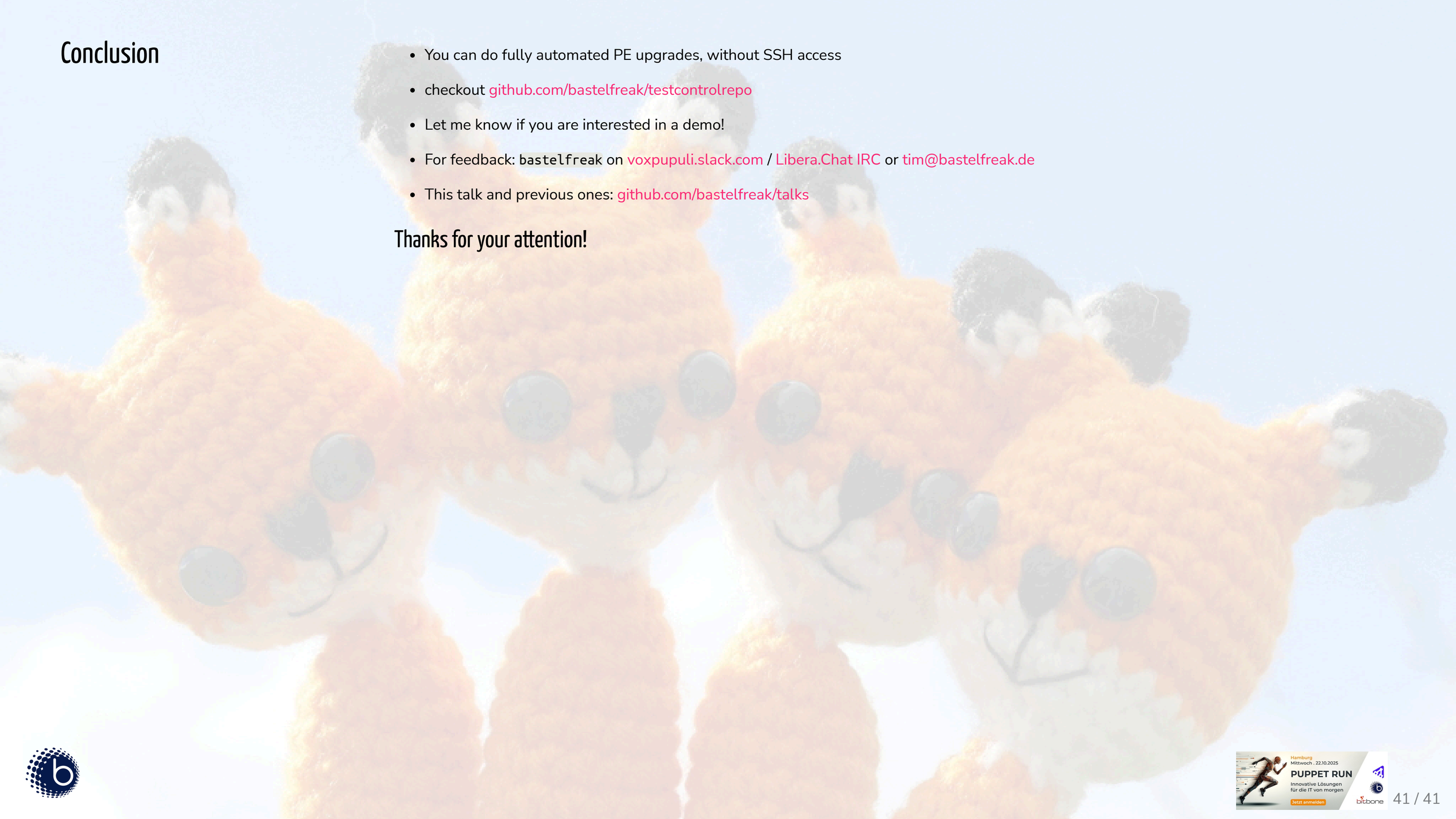


Conclusion

- You can do fully automated PE upgrades, without SSH access
- checkout github.com/bastelfreak/testcontrolrepo
- Let me know if you are interested in a demo!
- For feedback: `bastelfreak` on voxpupuli.slack.com / Libera.Chat IRC or tim@bastelfreak.de
- This talk and previous ones: github.com/bastelfreak/talks

Thanks for your attention!



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