Composer 2.0

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Goals for 2.0

- Performance Improvements
- Better reproducibility
  - Most serious 1.x bugs are edge cases which are difficult to debug and hard to reproduce
- Better error reporting
- New features which become easier to add by BC breaks/refactoring

- Keep upgrading as painless as possible

Why 2.0 at all and not 1.x?

Improving Performance

- What makes Composer slow?
  - I/O
    - Network
      - Metadata JSON downloads
      - Package file downloads
    - Memory access
      - Writing, accessing and modifying GBs of memory
  - CPU
    - Sequential unpacking of code archives

Improving Performance

What does Composer use memory for?

- JSON representation of every version of every package that may fit your requirements
- representation of dependencies/conflicts for SAT solver between all of these packages

Solutions

- Reduce number of package versions which “may fit my requirements”
- Represent dependencies/conflicts more efficiently

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Reduce number of package versions which “may fit my requirements”

- **Composer 1** lazy loads packages while creating memory representation of dependencies
  - Idea: Solver only loads what it needs when it gets to that point
  - Problems
    - Solver just waits for same info at a later point
    - Impossible to reduce set of packages before generating dependencies
    - Parallelized network access becomes hard to manage

Composer 2.0 refactors process into multiple clearly separated steps:

- Recursively download metadata only for package versions which may really get installed
- Reduce number of package versions in memory as far as possible
- Generate solver memory representation of dependencies

=> BC Break (for plugins) => 2.0

Represent dependencies/conflicts more efficiently

SAT Solver takes boolean expressions, e.g.

```
foo/bar 1.0 requires baz/qux ^2.0
foo/bar 1.0 conflicts with baz/qux ^2.0
```

```
(- foo/bar 1.0 | baz/qux 2.0.0 | baz/qux 2.0.1 | baz/qux 2.1.0)
(- foo/bar 1.0 |- baz/qux 2.0.0) & (- foo/bar 1.0 |- baz/qux 2.0.1) &
(- foo/bar 1.0 |- baz/qux 2.1.0)
```

You can only install one version of a package

=> automatically generate a conflict for each pair of versions

```
foo/bar 1.0, 1.1, 1.2
```

```
(- foo/bar 1.0 |- foo/bar 1.1) & (- foo/bar 1.0 |- foo/bar 1.2) &
(- foo/bar 1.1 |- foo/bar 1.2)
```

Extreme Growth $\binom{n}{2} = \frac{n!}{2(n-2)!}$

	3 versions	6 versions	100 versions	500 versions	1000 versions
Composer 1	3 rules	15 rules	4,950 rules	**124,750** rules	**499,500** rules
Composer 2	1 rule	1 rule	1 rule	1 rule	1 rule

Composer 2.0 uses a special single multi conflict rule representation for all of these rules

```
foo/bar 1.0, 1.1, 1.2
```

```
oneof(foo/bar 1.0, foo/bar 1.1,foo/bar 1.2)
```

Improving Performance: Network

- JSON Metadata & Package archive downloads
    - **Parallelization** of HTTP requests with curl multi
    - Use of **HTTP/2** features to reduce server round-trips
    - More reliable and feature complete than Composer 1 plugin implementations (hirak/prestissimo, symfony/flex) which were limited by plugin interface
- Packagist.org protocol improvements
    - Reduced amount of data transferred
    - Stability improvements to packagist.org infrastructure

Note: Improvements require ext-curl

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Improving Performance: Archive Extraction

- Composer 2.0 unzips all downloaded archives in parallel
  - Requires Linux/OS X/WSL
  - Requires CLI command unzip in $PATH

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Improving Performance

- What makes Composer slow?
  - I/O ✔
    - Network ✔
      - Metadata JSON downloads ✔
      - Package file downloads ✔
    - Memory access ✔
      - Writing, accessing and modifying GBs of memory ✔
        - Reduce number of package versions which “may fit my requirements” ✔
        - Represent dependencies/conflicts more efficiently ✔
  - CPU ✔
    - Sequential unpacking of code archives ✔

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Improving Performance

- Benchmarks?
  - Only anecdotal information so far

“Whoa, I tried Compsoer V2 alpha 1, nearly **80% faster** on a composer install”

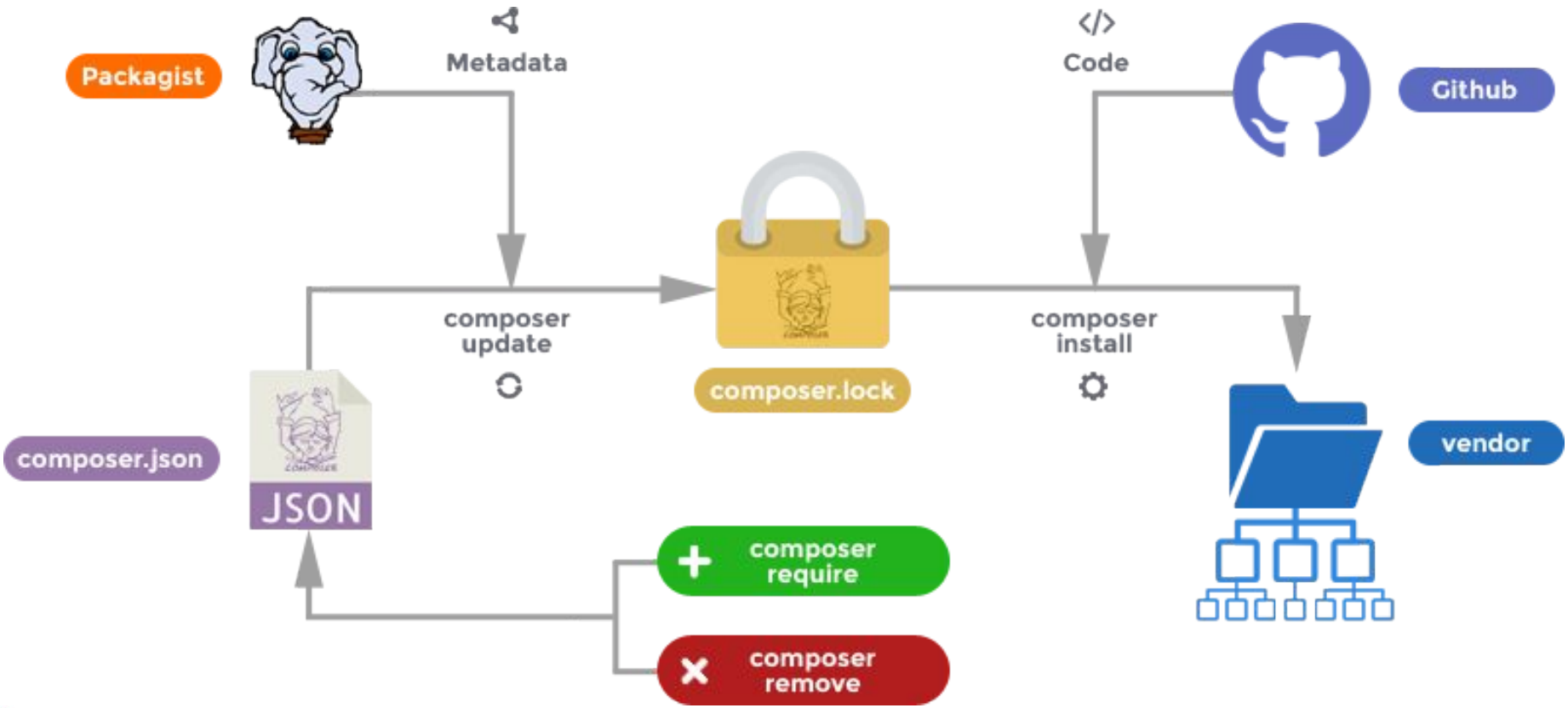
“Fast. Faster. Composer 2.0” “If you are still on PHP 7.3 you gain the most, Composer 2.x is about **2.5 times faster** than Composer 1.x. If you are already on PHP 7.4, Composer 2.x will be about **1.8 times faster.** This is really impressive!”

“composer update Spryker is seeing **64% memory reduction & 51% less time** - from **3.4GB to 1.2GB** and down from 2 minutes to 1 minute! Thanks to @sprysys for financially supporting this work through a Private Packagist subscription!”

Better Reproducibility:

composer update
vs
composer install

Separating update & install



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Separating update & install

vendor
  symfony/http-foundation 5.1.2 — previous local upgrade attempt
composer.lock
  symfony/http-foundation: 4.4.10 — old production state
composer.json
  symfony/http-foundation: 5.0.* — limited upgrade for now, because of 5.1 issues

```
naderman@saumur:~/projects/composer/test/symfony-http-foundation$ composer update
Loading composer repositories with package information
Updating dependencies
Lock file operations: 0 installs, 1 update, 0 removals
 - Upgrading symfony/http-foundation (v4.4.10 => v5.0.10)
Writing lock file
Installing dependencies from lock file (including require-dev)
Package operations: 3 installs, 1 update, 1 removal
 - Removing symfony/deprecation-contracts (v2.1.3)
 - Installing symfony/polyfill-php72 (v1.17.0): Extracting archive
 - Installing symfony/polyfill-intl-idn (v1.17.1): Extracting archive
 - Installing symfony/mime (v5.1.2): Extracting archive
 - Downgrading symfony/http-foundation (v5.1.2 => v5.0.10): Extracting archive
Generating autoload files
6 packages you are using are looking for funding.
Use the `composer fund` command to find out more!
```

New Features

Ignoring specific platform requirements

Trying to test your project on PHP8?

```
composer update --ignore-platform-reqs
```

Installs on PHP8

May install packages requiring PHP extensions you do not have

```
composer update --ignore-platform-req=php
```

Installs on PHP8

Checks all extension requirements as usual

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Partial Updates to specific versions

```
// composer.json

    "require": {
        "symfony/http-foundation": “^4.0 || ^5.0",
    }

// composer.lock

      "packages": [
        {
            "name": "symfony/http-foundation",
            "version": "v4.4.10",
```

```
$ composer update symfony/http-foundation:5.0
Loading composer repositories with package information
Updating dependencies
Lock file operations: 0 installs, 1 update, 0 removals
 - Upgrading symfony/http-foundation (v4.4.10 => v5.0.0)
Writing lock file
Installing dependencies from lock file (including require-dev)
Package operations: 0 installs, 1 update, 0 removals
 - Downloading symfony/http-foundation (v5.0.0)
 - Upgrading symfony/http-foundation (v4.4.10 => v5.0.0): Extracting archive
```

Repository Priorities

- Repositories are canonical by default:
  - First repository which has a package for a given name wins
  - use `"canonical": false` to restore old behavior of merging package versions
- Limit packages a repository can provide

```
{
    "type": "composer",
    "url": "https://some-third-party.com/composer-repo/",
    "only": ["foo/*", "bar/baz"],
    "exclude": ["foo/qux"]
}
```


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Upgrading your projects

Best Case

```
composer self-update --2
composer update / composer install
```

No errors, everything works as before.

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Upgrading issues with plugins

```
foo/bar requires composer-plugin-api ^1.0.0 -> no matching package found.
```

- Update foo/bar if new version with Composer 2.0 support available
- Contact author of foo/bar plugin
- Temporarily remove the requirement for the plugin to test

symfony/flex is compatible as of 1.8.0!

https://github.com/symfony/flex/pull/617

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ocramius/package-versions

- Compatible with Composer 2.0 as of 1.8.0
  - requires PHP ^7.4
- `composer require` **`composer/package-versions-deprecated`**
  - We forked the package, now compatible with PHP ^7.0
  - replaces ocramius/package-versions
    => satisfies all requirements of ocramius/package-versions

- Building new code requiring runtime access to package info?

  Runtime Composer Utilities
  https://github.com/composer/composer/blob/master/doc/07-runtime.md

  Automatically autoloaded in every Composer project

```php
\Composer\InstalledVersions::isInstalled('vendor/package'); // returns bool

use Composer\Semver\VersionParser;
\Composer\InstalledVersions::satisfies(new VersionParser, 'vendor/package', '2.0.*');
```


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Autoloading Issues

Check deprecation warnings in Composer1

```
Class Foo\Bar located in ./src/SomeName/Bar.php does not comply with psr-4 autoloading standard.
It will not autoload anymore in Composer v2.0. in
phar:///usr/local/bin/composer/src/Composer/Autoload/ClassMapGenerator.php:18
```

Make sure directories match class names as defined in PSR-0/4.

How far along is Composer 2.0?

Composer 2.0-alpha2 released June 24, 2020

- Works reliably in nearly all use cases
- A few refactorings and optimizations left before a beta/RC release
- **1.2%** of packagist.org installs from Composer 2.0 within last 30 days

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Help us test Composer 2.0

```
composer self-update --preview

Updating to version 2.0.0-alpha2 (preview channel).
  Downloading (100%)
Use composer self-update --rollback to return to version 1.10.8
```

Just run it locally for now, your lock file is commited, no risk involved!

Back to v1? `composer self-update --1`

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Resources

- Changelog
  https://github.com/composer/composer/blob/master/CHANGELOG.md
- Upgrade Guide
  https://github.com/composer/composer/blob/master/UPGRADE-2.0.md
- Packagist Blog: Development Update (April 24, 2020)
  https://blog.packagist.com/composer-2-development-update/
- Composer Plugin Readiness for 2.0
  https://github.com/composer/composer/issues/8726

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Questions / Feedback?

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