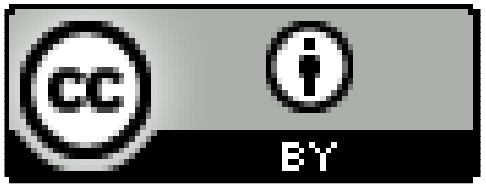
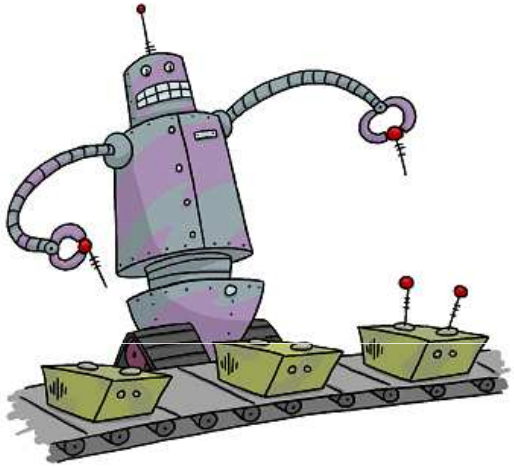
Automated Builds

Basics



Manage tasks and dependencies



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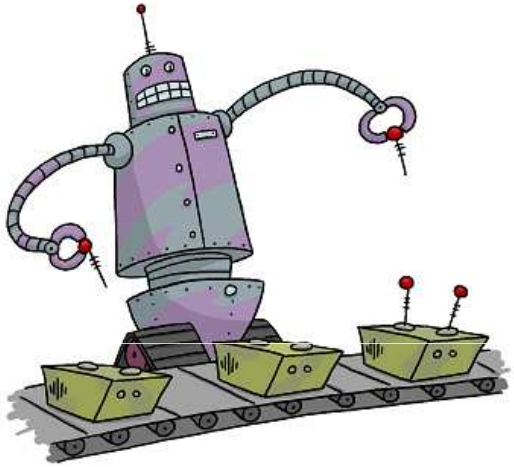

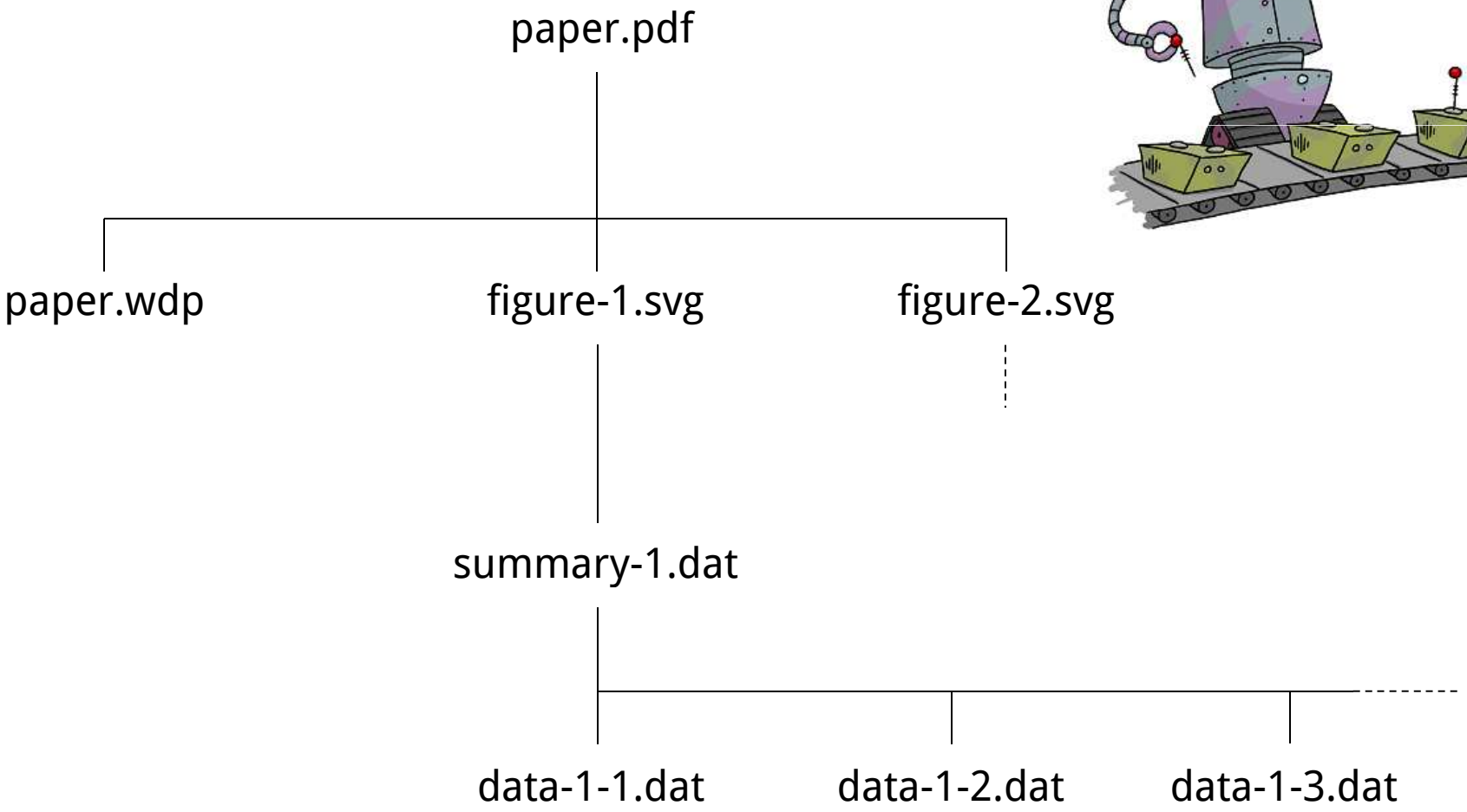

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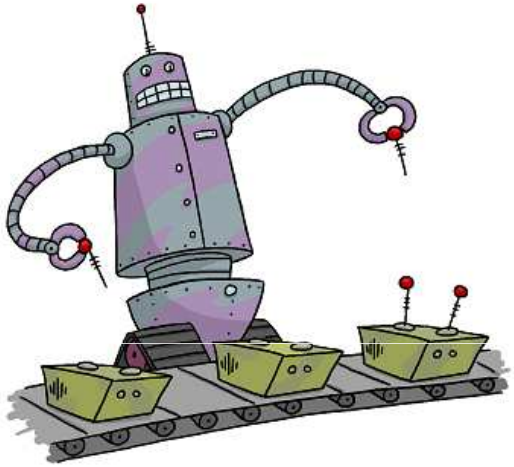

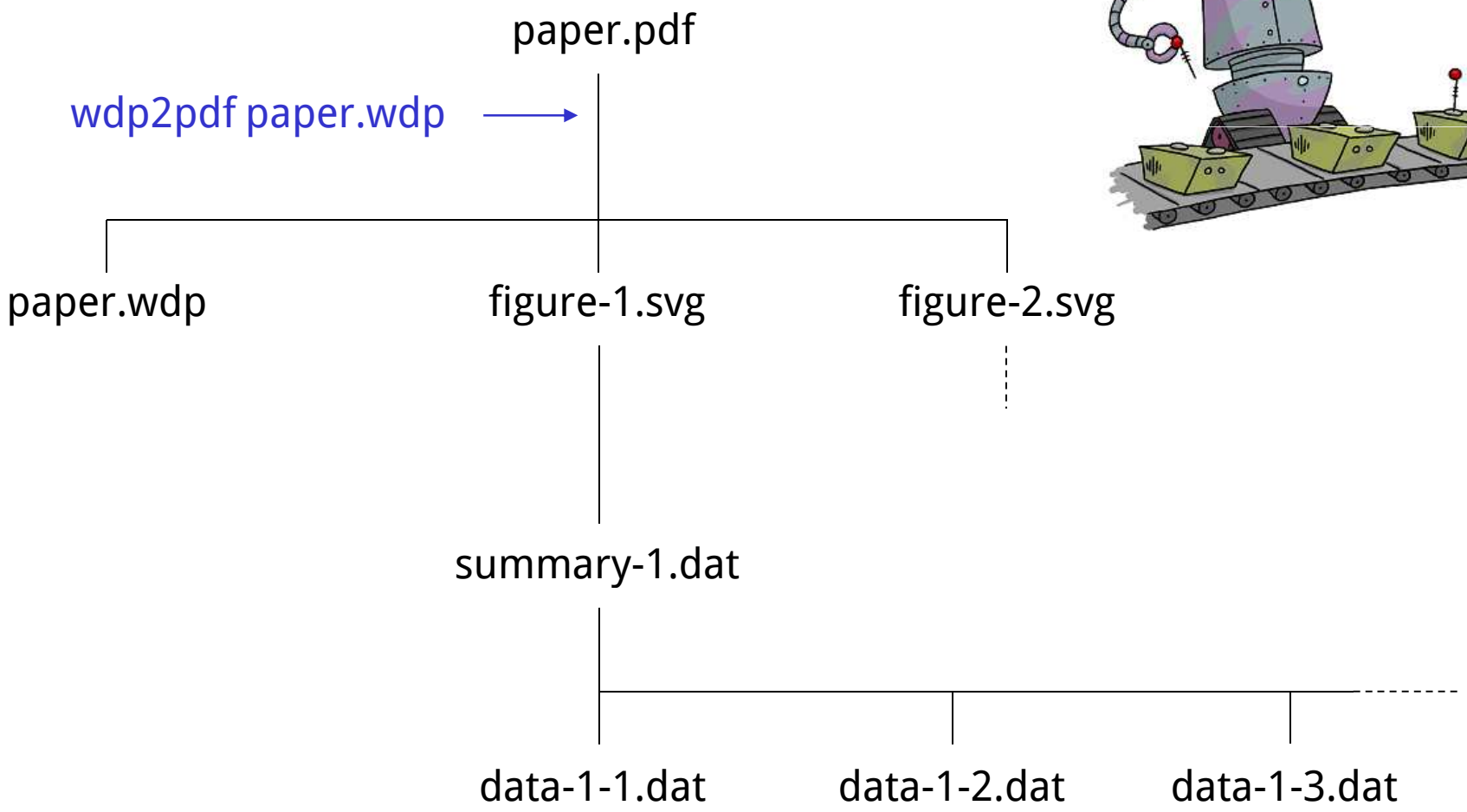

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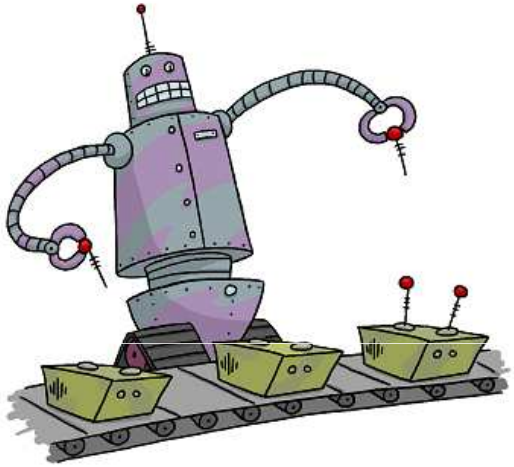
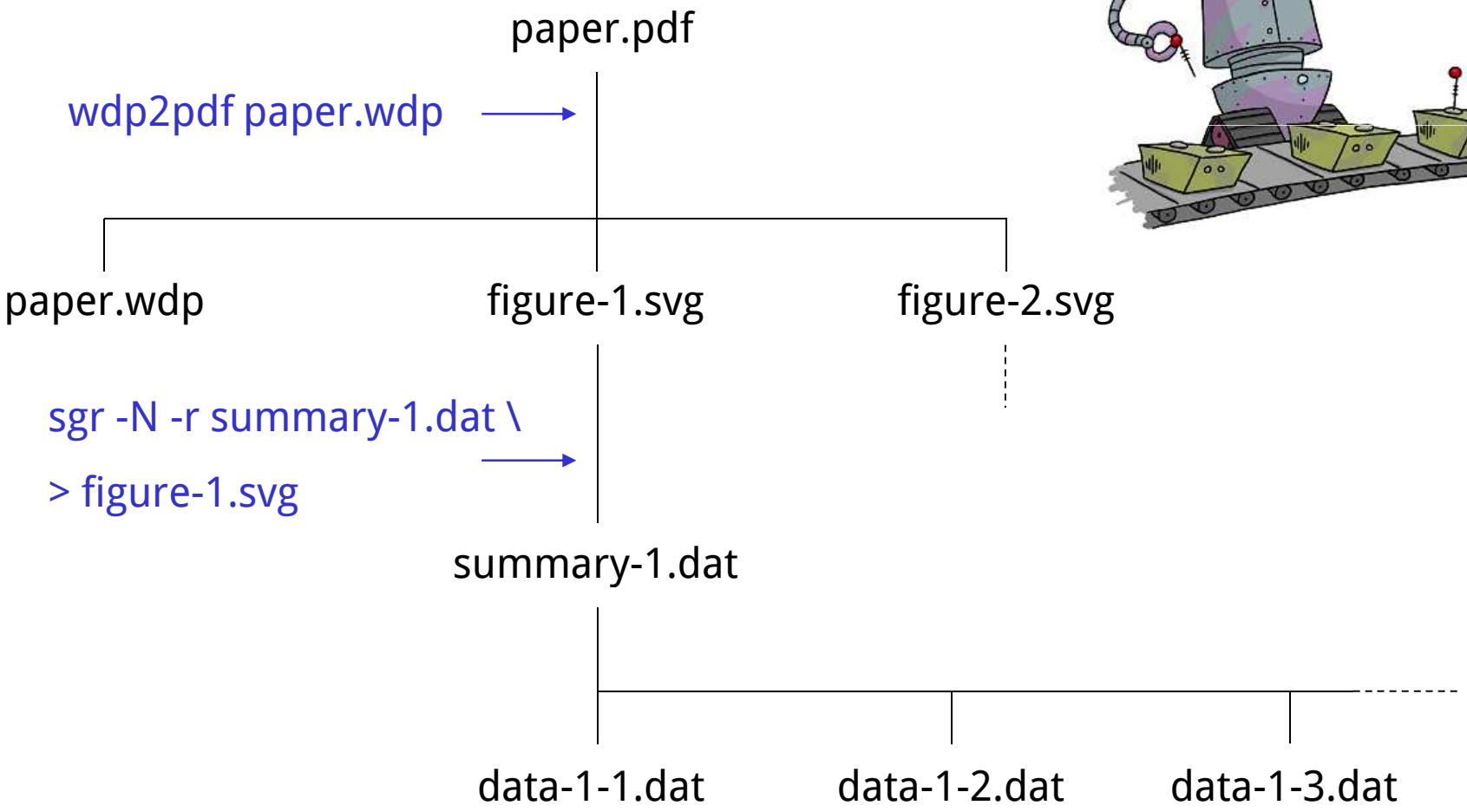
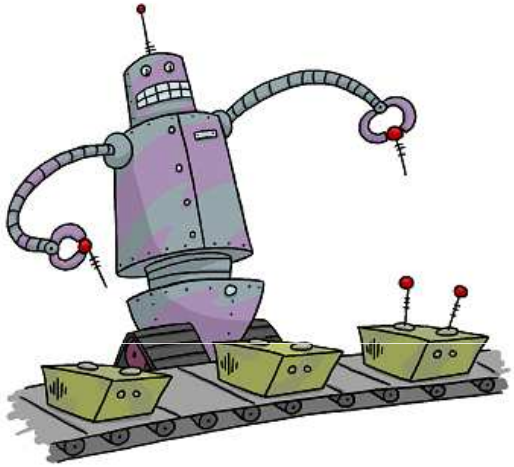
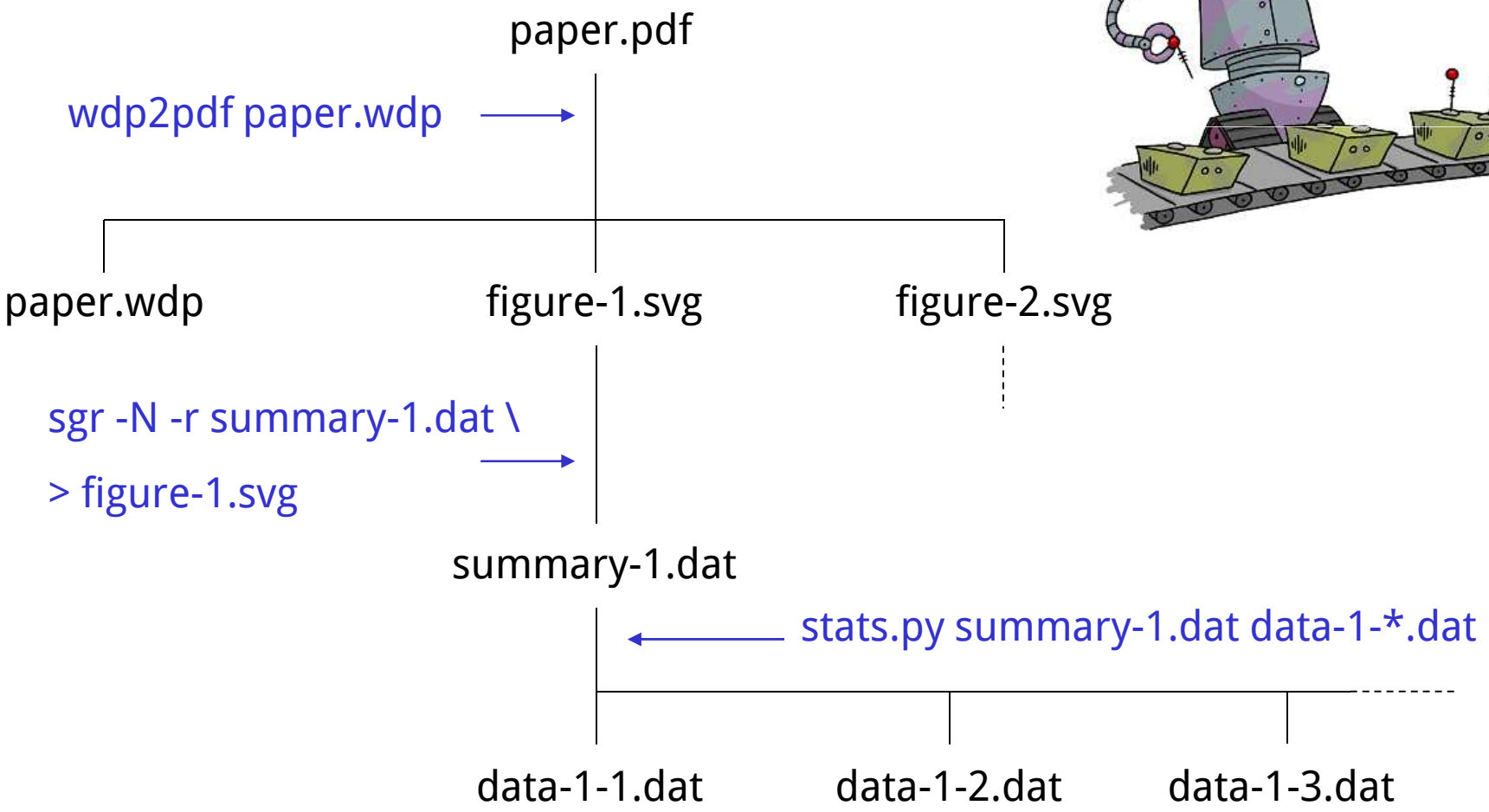


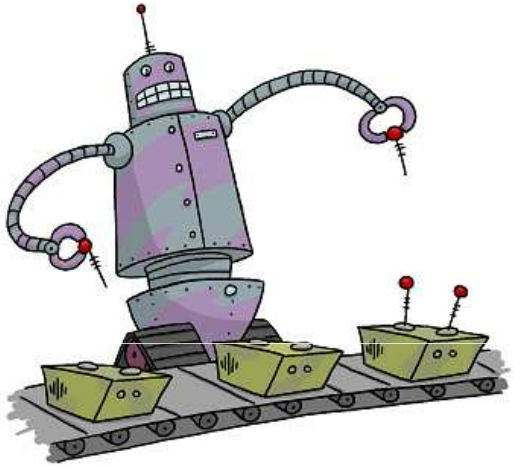


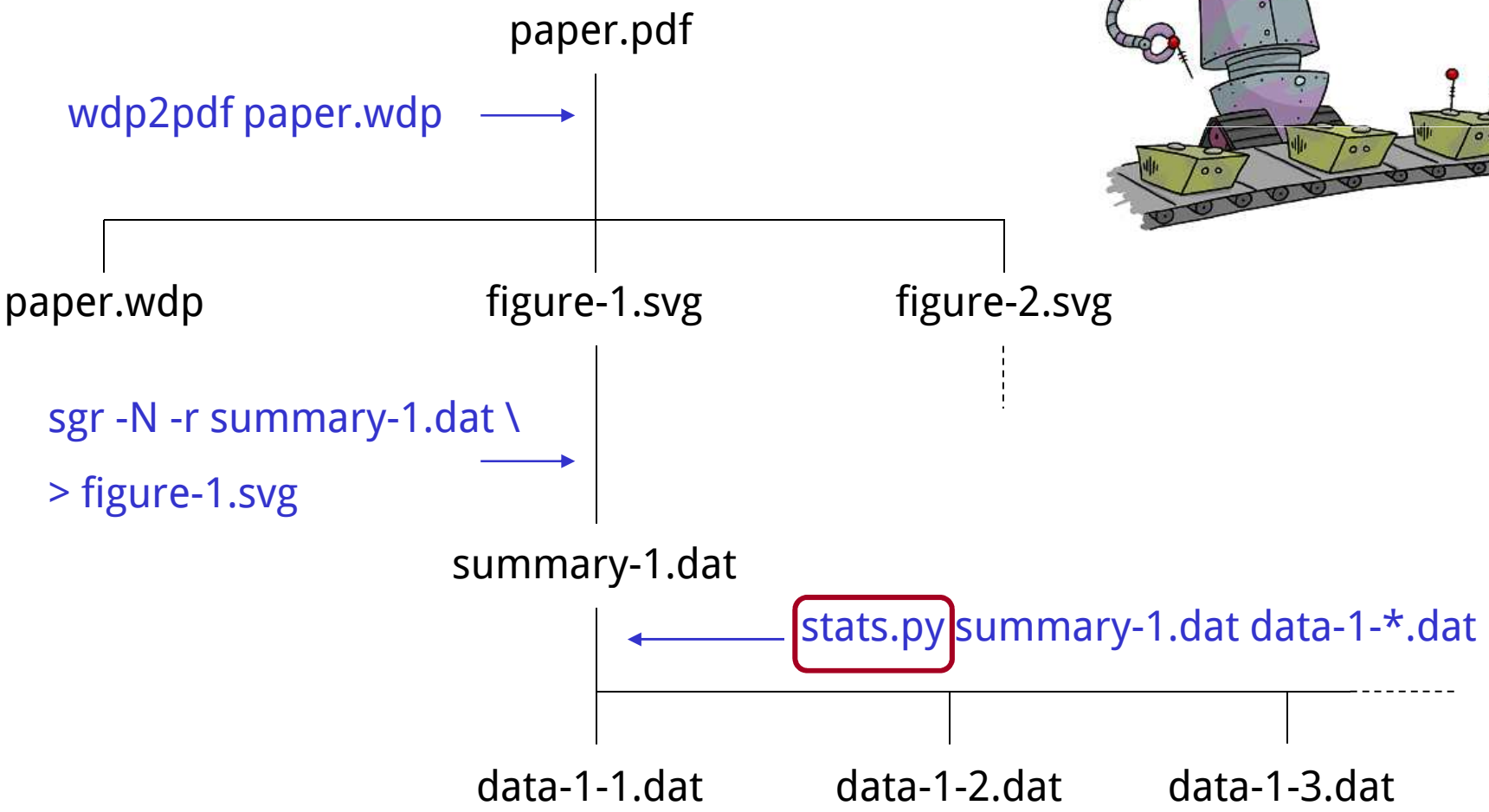
Manage tasks and dependencies



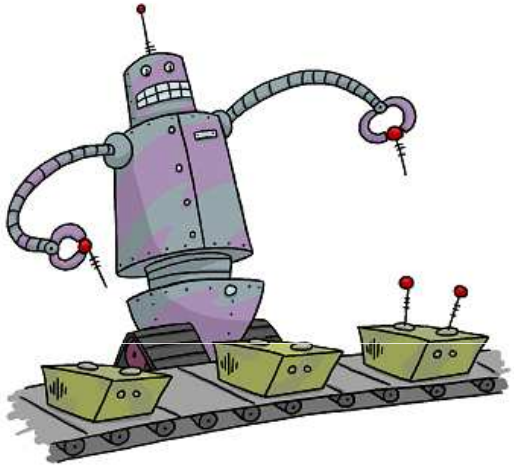


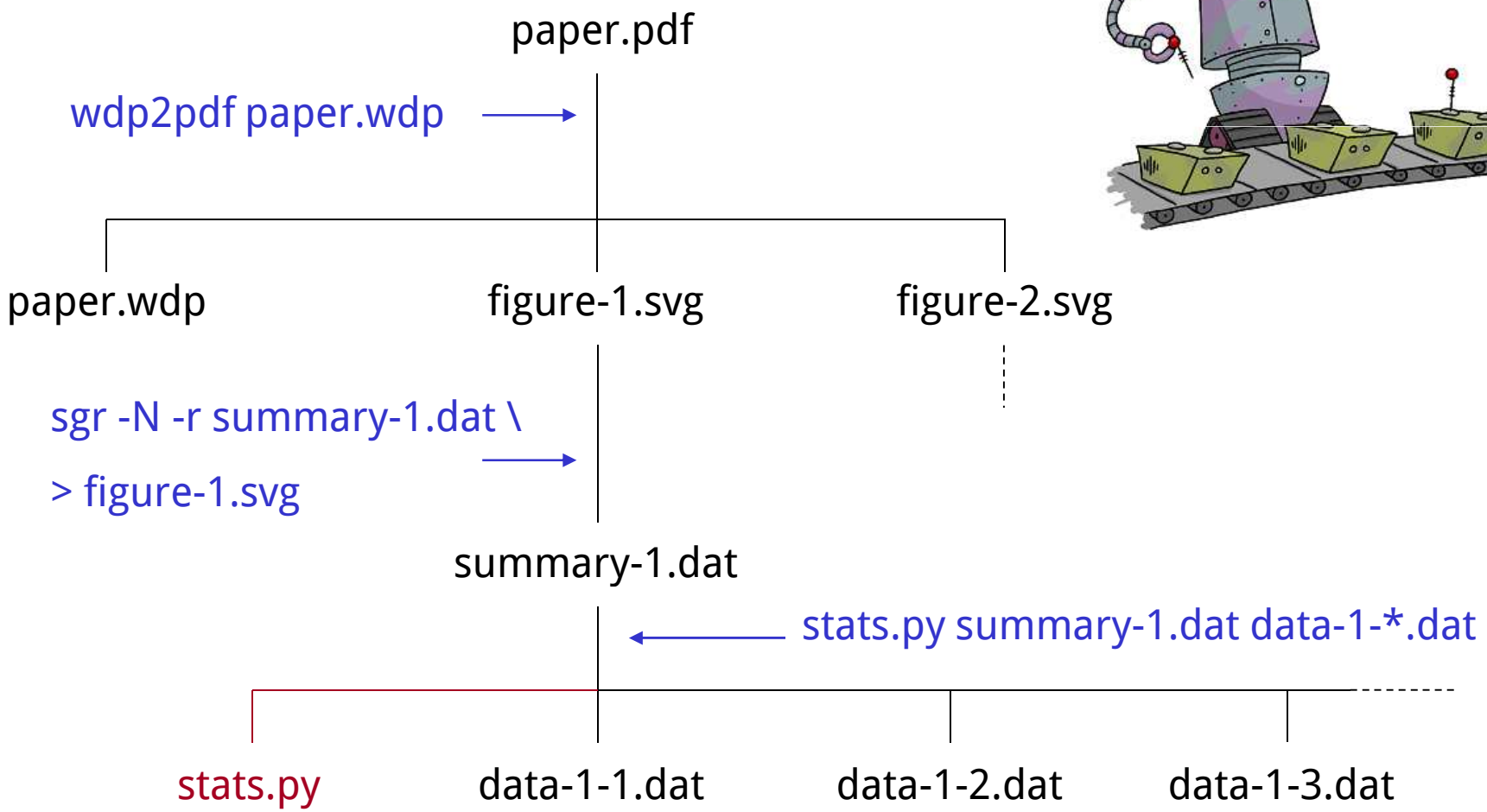
Manage tasks and dependencies





Manage tasks and dependencies





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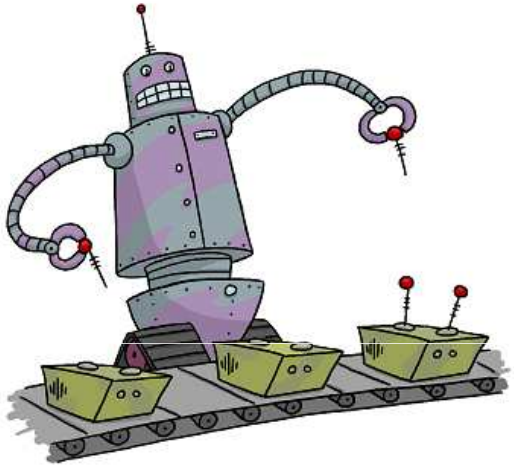

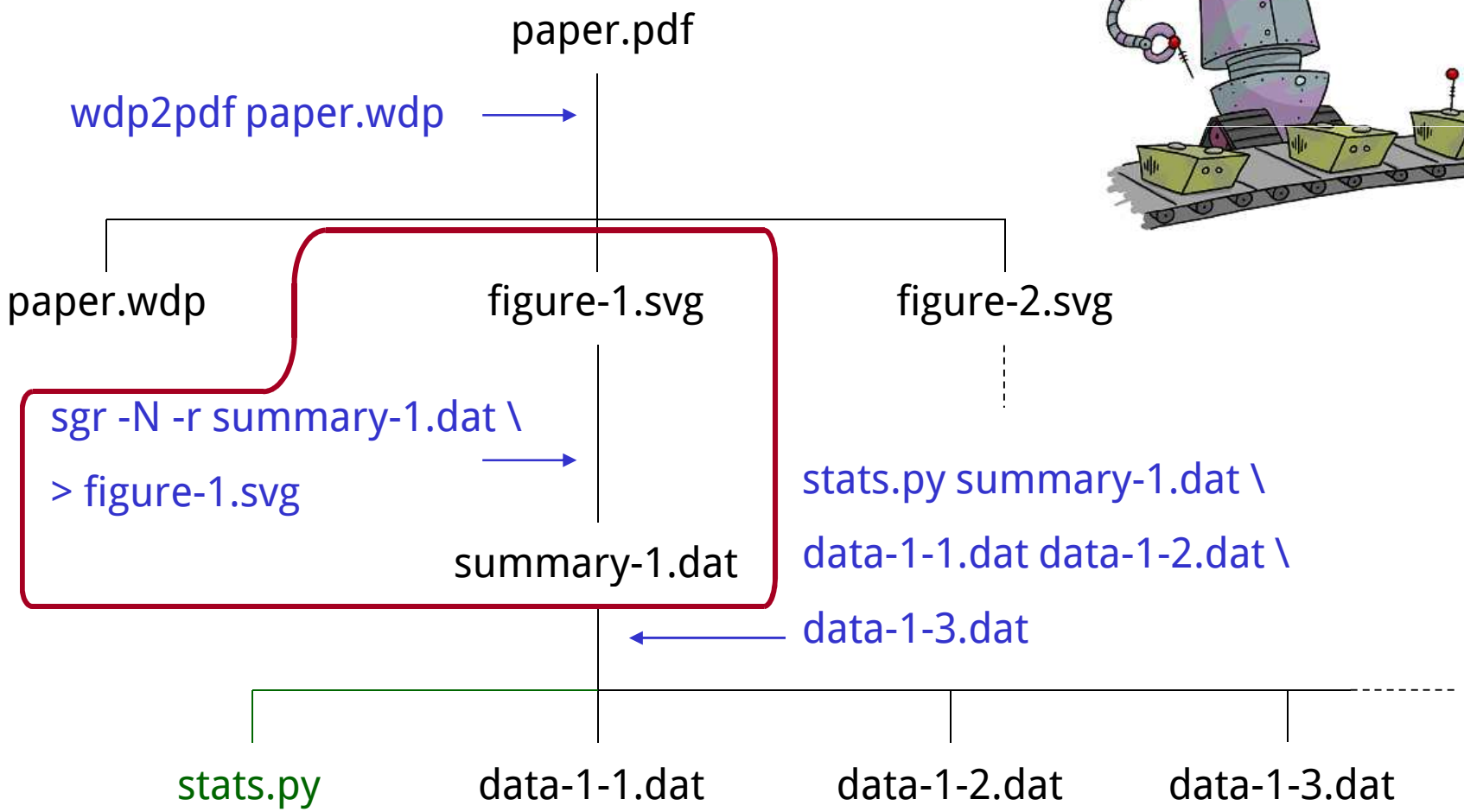

1. What is newer than what?

```
$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
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$
```

Data file is newer than SVG image

1. What is newer than what?

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$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
$
```

2. Put this in a *Makefile* called `hello.mk`

```
# hello.mk
figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg
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Comment

1. What is newer than what?

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summary-1.dat    figure-1.svg
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```

2. Put this in a *Makefile* called `hello.mk`

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# hello.mk
figure-1.svg : summary-1.dat
        sgr -N -r summary-1.dat > figure-1.svg
```

Rule

1. What is newer than what?

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$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
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```

2. Put this in a *Makefile* called `hello.mk`

```
# hello.mk
figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg
```

Target

1. What is newer than what?

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$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
$
```

2. Put this in a *Makefile* called `hello.mk`

```
# hello.mk
figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg
```

Prerequisite

1. What is newer than what?

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$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
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```

2. Put this in a *Makefile* called `hello.mk`

```
# hello.mk
figure-1.svg : summary-1.dat
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```

Action

1. What is newer than what?

```
$ ls -t *.dat *.svg
summary-1.dat    figure-1.svg
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```

2. Put this in a *Makefile* called `hello.mk`

```
# hello.mk
figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg
```

Must indent with a single tab character

3. Run GNU Make from the shell

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$ gmake -f hello.mk
```

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-f filename

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Prerequisite is newer than target

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$ gmake -f hello.mk
sgr -N -r summary-1.dat > figure-1.svg
$
```

Prerequisite is newer than target

So Make executes the action

3. Run GNU Make from the shell

```
$ gmake -f hello.mk
sgr -N -r summary-1.dat > figure-1.svg
$
```

4. Run Make again

```
$ gmake -f hello.mk
$
```

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$ gmake -f hello.mk
sgr -N -r summary-1.dat > figure-1.svg
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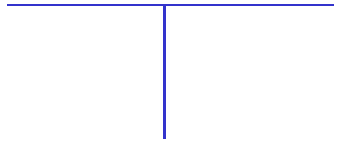

Target is newer than prerequisite

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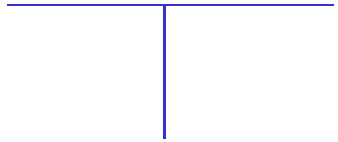

Target is newer than prerequisite

So action not executed

Usually have multiple rules per file

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```
# double.mk

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Usually have multiple rules per file

```
# double.mk

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Force it to run

```
$ touch *.dat
$
```

Usually have multiple targets per file

```
# double.mk

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Force it to run

```
$ touch *.dat
$
```


Update timestamps on files

Usually have multiple targets per file

```
# double.mk

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Force it to run

```
$ touch *.dat
$ gmake -f double.mk
sgr -N -r summary-1.dat > figure-1.svg
$
```

Usually have multiple targets per file

```
# double.mk

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Force it to run

```
$ touch *.dat
$ gmake -f double.mk
sgr -N -r summary-1.dat > figure-1.svg
$
```

Why isn't `figure-2.svg` rebuilt?

First rule in Makefile is *default rule*

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Make only does this unless told otherwise

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Force it to rebuild `figure-2.svg` explicitly

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First rule in Makefile is *default rule*

Make only does this unless told otherwise

Force it to rebuild `figure-2.svg` explicitly

```
$ gmake -f double.mk figure-2.svg
sgr -N -r summary-2.dat > figure-2.svg
$
```

Better than typing commands

one by one, but only slightly

Introduce a *phony target*

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Doesn't correspond to a file

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So never up to date

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But things can depend on it

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Doesn't correspond to a file

So never up to date

But things can depend on it

```
# phony.mk

all : figure-1.svg figure-2.svg

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

Introduce a *phony target*

Doesn't correspond to a file

So never up to date

But things can depend on it

```
# phony.mk

all : figure-1.svg figure-2.svg

figure-1.svg : summary-1.dat
	sgr -N -r summary-1.dat > figure-1.svg

figure-2.svg : summary-2.dat
	sgr -N -r summary-2.dat > figure-2.svg
```

"`make all`" rebuilds everything

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```
$ touch *.dat
$ gmake -f phony.mk
sgr -N -r summary-1.dat > figure-1.svg
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$
```

"make all" rebuilds everything

```
$ touch *.dat
$ gmake -f phony.mk
sgr -N -r summary-1.dat > figure-1.svg
sgr -N -r summary-2.dat > figure-2.svg
$
```

Order is not guaranteed

"make all" rebuilds everything

```
$ touch *.dat
$ gmake -f phony.mk
sgr -N -r summary-1.dat > figure-1.svg
sgr -N -r summary-2.dat > figure-2.svg
$
```

Order is not guaranteed

Could re-create `figure-2.svg` first

"make all" rebuilds everything

```
$ touch *.dat
$ gmake -f phony.mk
sgr -N -r summary-1.dat > figure-1.svg
sgr -N -r summary-2.dat > figure-2.svg
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```

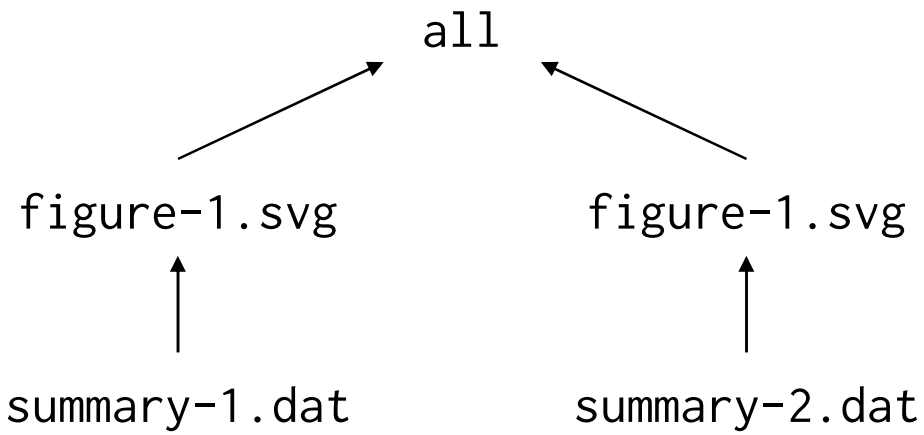
- Order is not guaranteed
- Could re-create `figure-2.svg` first
- Or re-create both in parallel

"make all" rebuilds everything

```
$ touch *.dat
$ gmake -f phony.mk
sgr -N -r summary-1.dat > figure-1.svg
sgr -N -r summary-2.dat > figure-2.svg
$
```

- Order is not guaranteed
- Could re-create `figure-2.svg` first
- Or re-create both in parallel
- Return to that idea later

Things can be both targets and prerequisites



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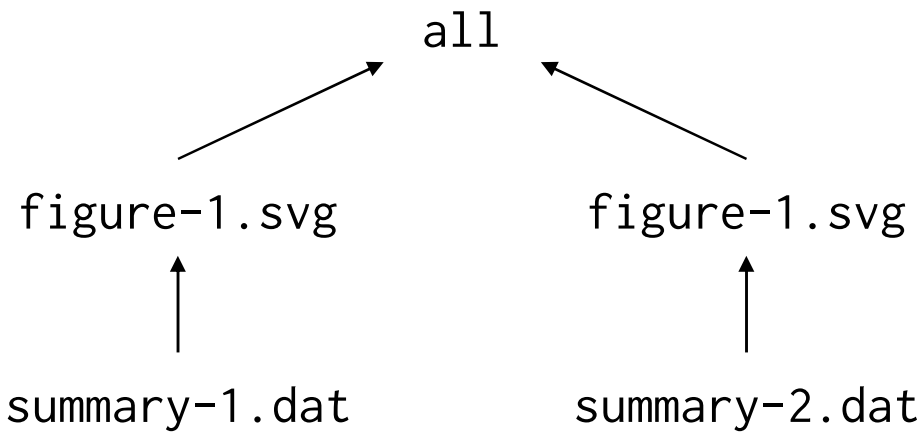
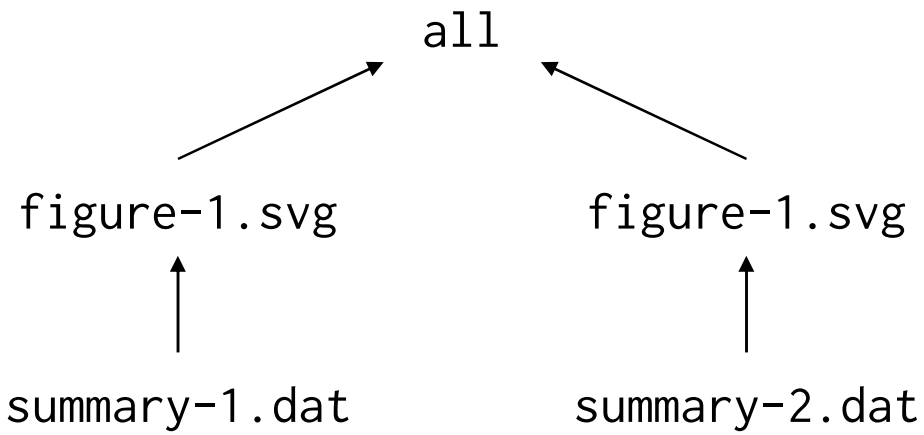


A *directed graph*

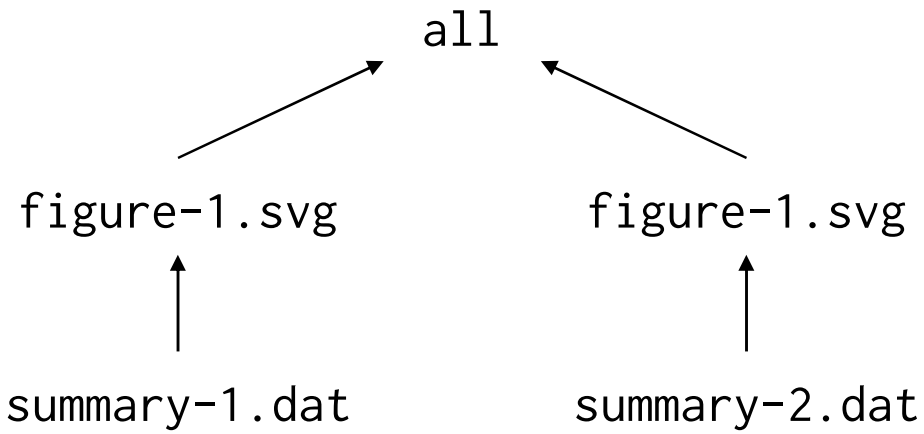
Things can be both targets and prerequisites



A *directed graph*

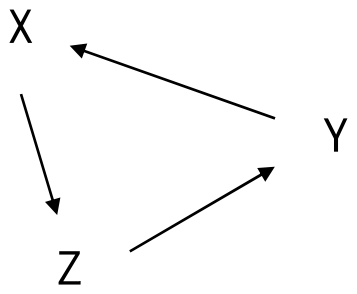
Must be *acyclic*

Things can be both targets and prerequisites

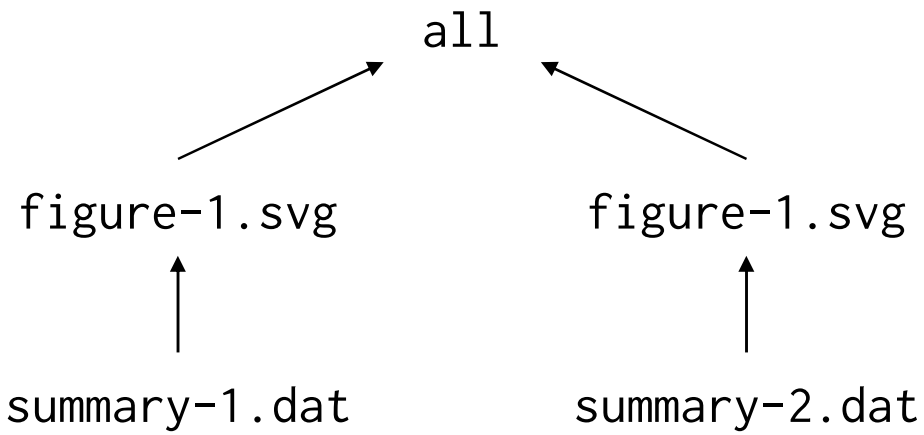


A *directed graph*

Must be *acyclic*

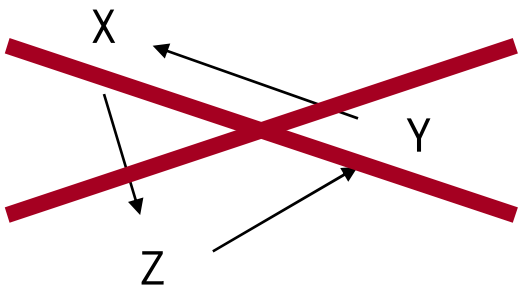


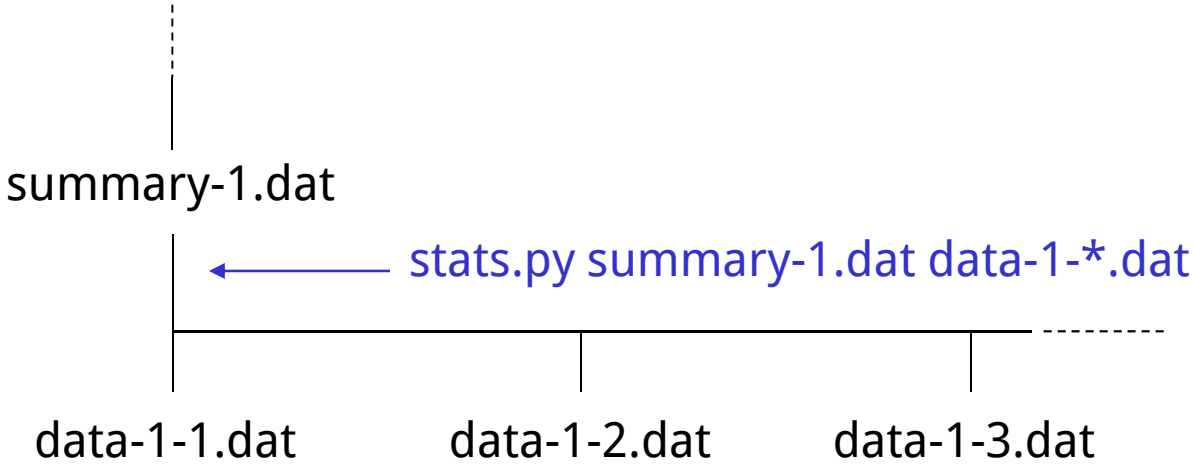
Things can be both targets and prerequisites

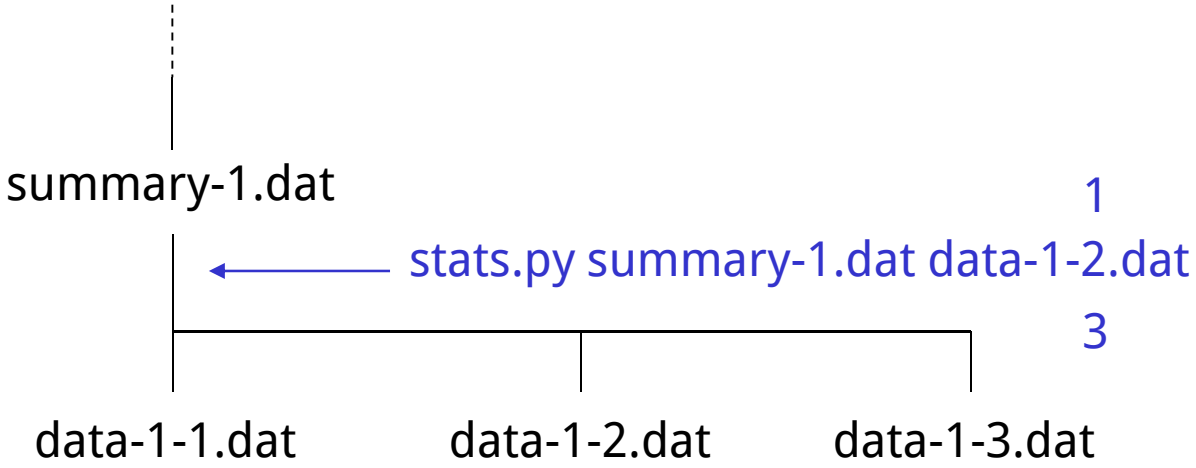


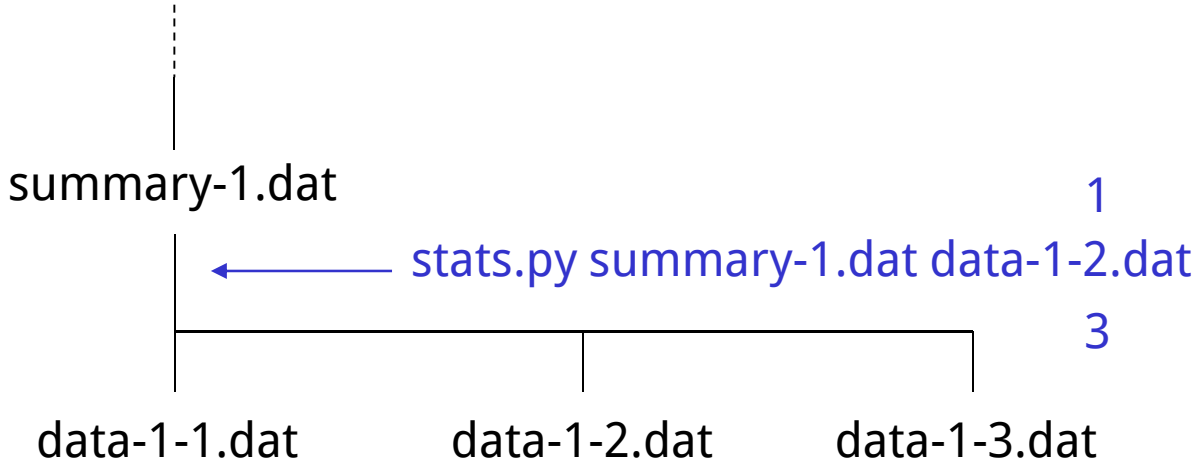
A *directed graph*

Must be *acyclic*



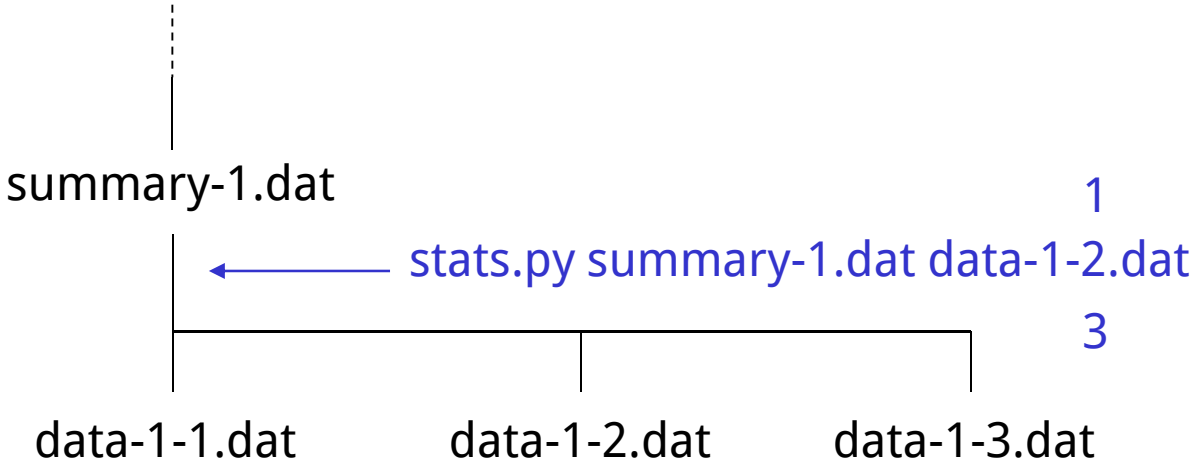

summary-1.dat
stats.py summary-1.dat data-1-*.dat
data-1-1.dat
data-1-2.dat
data-1-3.dat


summary-1.dat
1
stats.py summary-1.dat data-1-2.dat
3
data-1-1.dat
data-1-2.dat
data-1-3.dat




```
# multiple.mk

summary-1.dat : data-1-1.dat data-1-2.dat data-1-3.dat
        stats.py summary-1.dat data-1-1.dat data-1-2.dat data-1-3.dat
```

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summary-1.dat : data-1-1.dat data-1-2.dat data-1-3.dat
        stats.py summary-1.dat data-1-1.dat data-1-2.dat data-1-3.dat
```
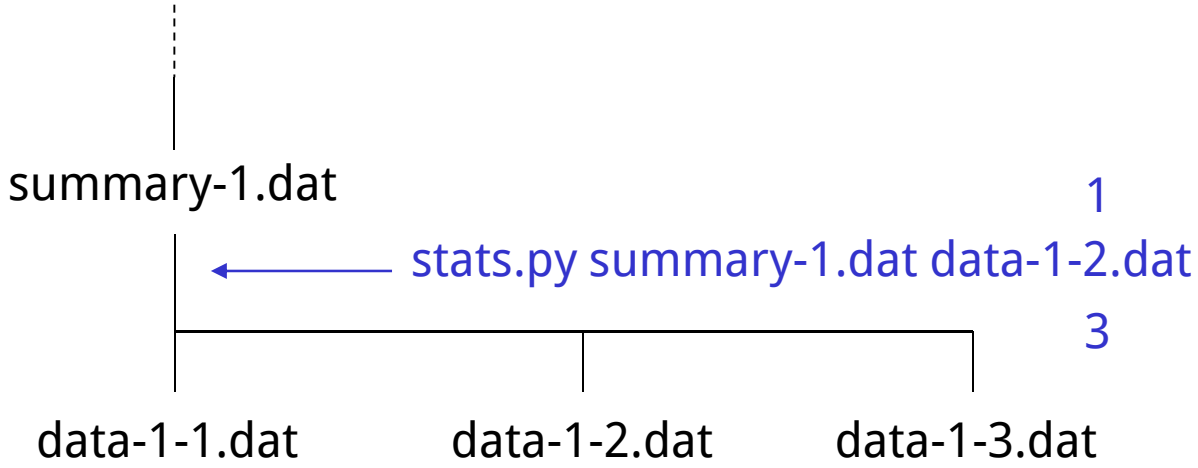

How to generalize to any number of files?




```
# multiple.mk

summary-1.dat : data-1-1.dat data-1-2.dat data-1-3.dat
        stats.py summary-1.dat data-1-1.dat data-1-2.dat data-1-3.dat
```

How to generalize to any number of files?

And get rid of repeated filenames

created by

Greg Wilson

August 2010