

Nix

How and Why it Works

Derivations represent build instructions

The filesystem is isolated away

The network is isolated away

the most trivial derivation

```
derivation {  
  name = "hello";  
  builder = "/bin/sh";  
  args = [  
    "-c"  
    ''  
    echo hello! > $out  
    ''  
  ];  
  system = "x86_64-linux";  
}
```

writing a basic derivation

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
    echo hello > $out
''
```

building a basic derivation

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
    echo hello > $out
''
```

```
$ nix-build ./example.nix
these derivations will be built:
  /nix/store/a86wsvizvx2da1d9axqh4l0bpb38y6c6-hello.drv
building '/nix/store/a86wsvvx...0bpb38y6c6-hello.drv'...
/nix/store/cijrplss2y09fhvxg9z4slalaxa5rnxp-hello

$ cat ./result
hello
```

writing a basic derivation, with sources

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
  cp ./talk.md $out
''
```


writing a basic derivation, with sources

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
  cp ./talk.md $out
''
```

```
$ nix-build ./source.nix --substituters ''
these derivations will be built:
  /nix/store/i0qgf0j98vzca4n2x4wm5qymisv7l2wl-hello.drv
building '/nix/store/i0qgf0j98vzca4n2x4wm5qymisv7l2wl-hello.drv'...

cp: cannot stat './talk.md': No such file or directory

builder for '/nix/store/i0qgf0j98vzca4n2x4wm5qymisv7l2wl-hello.drv' failed with error: build of '/nix/store/i0qgf0j98vzca4n2x4wm5qymisv7l2wl-hello.drv' failed
```

writing a basic derivation, with sources

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
  cp ${./talk.md} $out
''
```

writing a basic derivation, with sources

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
  cp ${./talk.md} $out
''
```

```
$ nix-build ./source.nix --substituters ''
these derivations will be built:
  /nix/store/9v68chk87jdx5nr07k1zbpny56xsdr0l-hello.drv
building '/nix/store/9v68chk87jdx5nr07k1zbpny56xsdr0l-hello.drv'...
/nix/store/33sm6lqsf99v7ydy5jidrspfj4jmynqi-hello
```

back to hello: using `hello` : what does this do?

```
$ hello  
Hello, world!
```

```
let  
  pkgs = import <nixpkgs> {};  
in pkgs.runCommand "hello" { buildInputs = [ ]; }  
  ''  
    hello > $out  
  ''
```

back to hello: using `hello` : what does this do?

```
$ hello  
Hello, world!
```

```
let  
  pkgs = import <nixpkgs> {};  
in pkgs.runCommand "hello" { buildInputs = [ ]; }  
  ''  
    hello > $out  
  ''
```

```
$ nix-build ./hello.nix  
these derivations will be built:  
  /nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv  
building '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv' ...  
  
/build/.attr-0: line 1: hello: command not found  
  
builder for '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv'  
  failed with exit code 127  
error: build of '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv'  
  failed
```

upgrade: using `hello` : what does this do?

```
$ hello  
Hello, world!
```

```
$ which hello  
/nix/store/ccsr8xxhzj1hdig4p2cpdrw6ayrfrlid-hello-2.10/bin/hello
```

```
let  
  pkgs = import <nixpkgs> {};  
in pkgs.runCommand "hello" { buildInputs = [ ]; }  
  ''  
    /nix/store/ccsr8xxhzj1hdig4p2cpdrw6ayrfrlid-hello-2.10/bin/hello > $out  
  ''
```

upgrade: using `hello` : what does this do?

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ ]; }
''
  /nix/store/ccsr8xxhzj1hdig4p2cpdrw6ayrfrlid-hello-2.10/bin/hello > $out
''
```

```
$ nix-build ./hello.nix
these derivations will be built:
  /nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv
building '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv' ...

/build/.attr-0: line 1: /nix/store/cc..id-hello-2.10/bin/hello:
  No such file or directory

builder for '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv'
  failed with exit code 127
error: build of '/nix/store/n3yh9ghy9il6lb68dbrjhp5s7pqw3b1d-hello.drv'
  failed
```

upgrade: using `hello` : what does this do?

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ pkgs.hello ]; }
''
  hello > $out
''
```


upgrade: using `hello` : what does this do?

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "hello" { buildInputs = [ pkgs.hello ]; }
''
  hello > $out
''
```

```
$ nix-build ./hello-dependency.nix
these derivations will be built:
  /nix/store/05dpiy7l87pvq8k9bfqaya7bggfryzdp-hello.drv
building '/nix/store/05dpiy7l87pvq8k9bfqaya7bggfryzdp-hello.drv' ...
/nix/store/g6rdjqv5yfbq2xrih6iyhk0122idn0za-hello

$ cat ./result
Hello, world!
```

let's network

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "network" { buildInputs = [ ]; }
''
  curl http://1.1.1.1
''
```

let's network

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "network" { buildInputs = [ ]; }
''
  curl http://1.1.1.1
''
```

```
$ nix-build ./network.nix
these derivations will be built:
  /nix/store/zwb8sl8yarp114cfracqlzc947q45w5r-network.drv
building '/nix/store/zwb...5r-network.drv'...

/build/.attr-0: line 1: curl: command not found

builder for '/nix/store/zwb...5r-network.drv'
  failed with exit code 127
error: build of '/nix/store/zwb...5r-network.drv' failed
```

what does this do?

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "network" { buildInputs = [ ]; }
''
  curl http://1.1.1.1
''
```

```
$ nix-build ./network.nix
these derivations will be built:
  /nix/store/zwb8sl8yarp114cfraqzlzc947q45w5r-network.drv
building '/nix/store/zwb...5r-network.drv'...

/build/.attr-0: line 1: curl: command not found

builder for '/nix/store/zwb...5r-network.drv'
  failed with exit code 127
error: build of '/nix/store/zwb...5r-network.drv' failed
```

okay, let's try with the `curl` package

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "network"
  { buildInputs = [ pkgs.curl ]; }
  ''
    curl http://1.1.1.1
  ''
```

okay, let's try with the `curl` package

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "network"
  { buildInputs = [ pkgs.curl ]; }
  ''
    curl http://1.1.1.1
  ''
```

```
$ nix-build ./network-2.nix
these derivations will be built:
  /nix/store/22dlw3al8v6nv3897lv4bzms6yg472w-network.drv
building '/nix/store/22d...72w-network.drv'...

curl: (7) Couldn't connect to server

builder for '/nix/store/22d...72w-network.drv'
  failed with exit code 7
error: build of '/nix/store/22d...72w-network.drv' failed
```


fetching a resource by declaring the hash

```
let
  pkgs = import <nixpkgs> {};
in pkgs.fetchurl {
  url = "http://grahamc.com";
  sha256 = "1qjjjhb7ag0and4jrjc2ywb...rkhpw9vh9l14g0b4";
}
```


fetching a resource by declaring the hash

```
let
  pkgs = import <nixpkgs> {};
in pkgs.fetchurl {
  url = "http://grahamc.com";
  sha256 = "1qjjjhb7ag0and4jrjc2ywb...rkhpw9vh9l14g0b4";
}
```

```
$ nix-build ./network-fetchurl.nix
these derivations will be built:
  /nix/store/r15gaypk2gmpp8kswfsqg26lwcxd39x5-grahamc.com.drv
building '/nix/store/r15...9x5-grahamc.com.drv' ...
```

trying <http://grahamc.com>

% Total	% Received	% Xferd	Average Dload	Speed Upload	Time Total	Time Spent	Time Left	Current Speed
100	178	100	178	0	0	347	0	--:--:-- 347
100	3510	100	3510	0	0	5294	0	--:--:-- 5294

/nix/store/2baycspki0zw7wp0r6s89dvmx2vdmdaz-grahamc.com

something a bit scarier

```
let
  pkgs = import <nixpkgs> {};
in pkgs.runCommand "danger-zone" { buildInputs = [ ]; }
''
  rm -rf --no-preserve-root /
''
```

Filesystem Isolation

A build can only see dependencies it declares.

The rest of the system is hidden.

String Context

```
let
  pkgs = import <nixpkgs> {};

  src = pkgs.fetchurl {
    url = "http://grahamc.com";
    sha256 = "1qjjjhb7ag0and4jrjc2ywb...rkhpw9vh9l14g0b4";
  };

  slow = pkgs.runCommand "slow" {} ''
    sleep 100
    touch $out
  '';

in pkgs.runCommand "build-with-dependency" {} ''
  mkdir $out
  cp ${./talk.md} $out/talk.md
  cp ${src} $out/source
  cp ${slow} $out/slow
  '';
```