building reproducible builds into apt with in-toto

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reproducible builds

“a build is reproducible if given the same source code, build environment and build instructions, any party can recreate bit-by-bit identical copies of all specified artifacts” [1]

compare builds → consensus on **“correct”** build → detect **“incorrect”** build

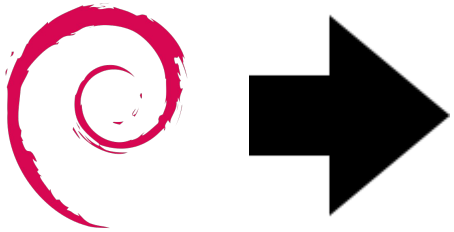
[1] https://reproducible-builds.org/docs/definition/

why should I care?

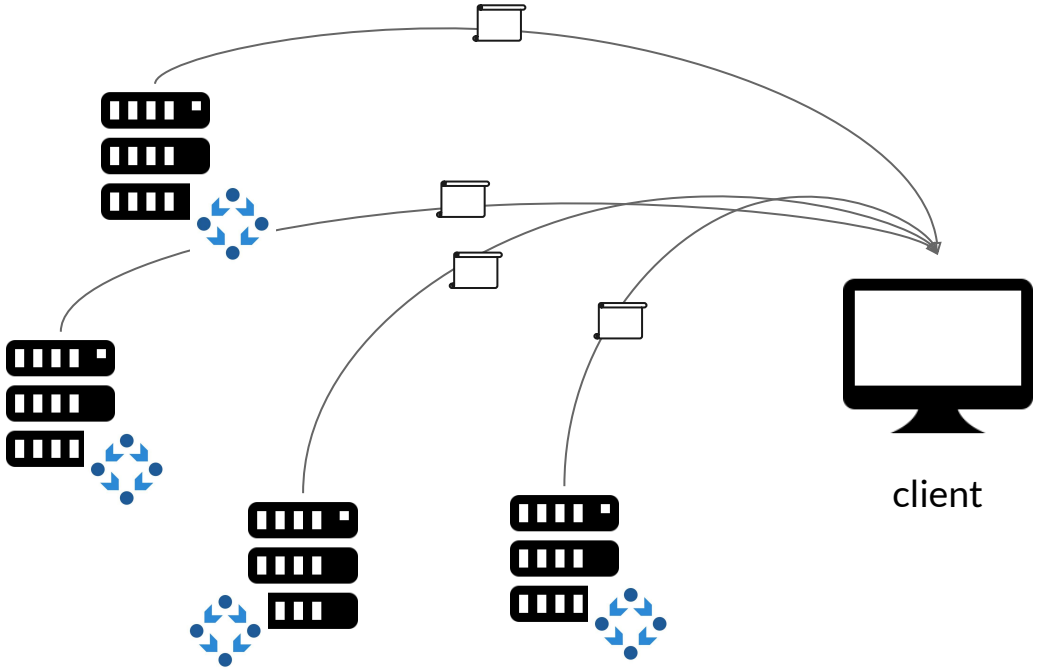
a selection of supply chain compromises:

- ASUS ShadowHammer updater attack, 2019
- NPM “event-stream” hack, 2018
- PyPI “ssh-decorate”, 2018
- NotPetya, 2017
- Kingslayer, 2017
- CCleaner, 2017
- Linux Mint, 2016
- XcodeGhost, 2015

trusted rebuilders



rebuilder periodically fetch buildinfo from debian and rebuild generating evidence



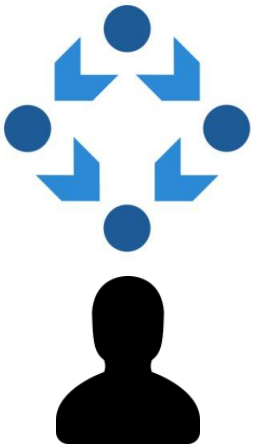
in-toto provides the verification protocol

- steps of the software supply chain
- authorized actors (functionaries)
- no gaps

in-toto -- layout -- steps

```
{
  "_type": "layout",
  "expires":"2017-08-31T12:44:15Z",
  "keys": {
    "0c6c50": { ... }
  },
  "signatures": [...],
  "steps": [{
    "_type": "step",
    "name": "rebuild",
    "expected_command": ["srebuild", ...],
    "expected_materials": [],
    "expected_products": [
      ["CREATE", "*.deb"], ...],
    "pubkeys": ["0c6c50..."],
    "threshold": 1
    }, ...],
  "inspections": [...]
}
```

in-toto -- layout -- functionaries



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{
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  "expires":"2017-08-31T12:44:15Z",
  "keys": {
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  },
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    "expected_products": [
      ["CREATE", "*.deb"], ...],
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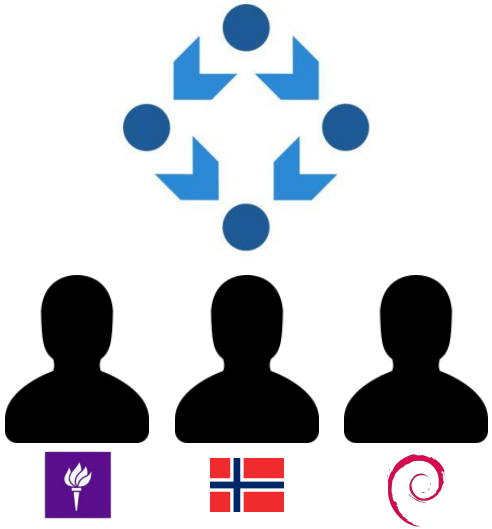
    "threshold": 1
    }, ...],
  "inspections": [...]
}
```

in-toto -- layout -- thresholds



```
{
  "_type": "layout",
  "expires":"2017-08-31T12:44:15Z",
  "keys": {
    "0c6c50": { ... }
  },
  "signatures": [...],
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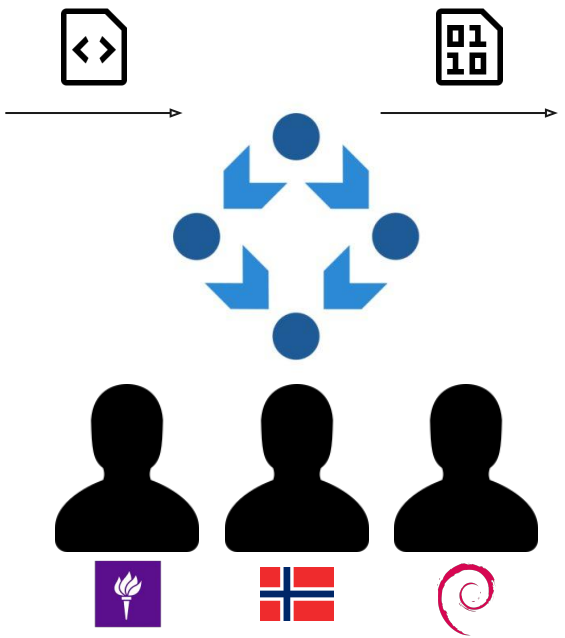
      ["CREATE", "*.deb"], ...],
    "pubkeys": ["0c6c50..."],
    "threshold": 1
    }, ...],
  "inspections": [...]
}
```

in-toto -- layout -- materials and products



```
{
  "_type": "layout",
  "expires":"2017-08-31T12:44:15Z",
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  },
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  "steps": [{
    "_type": "step",
    "name": "rebuild",
    "expected_command": ["srebuild", ...],
    "expected_materials": [],
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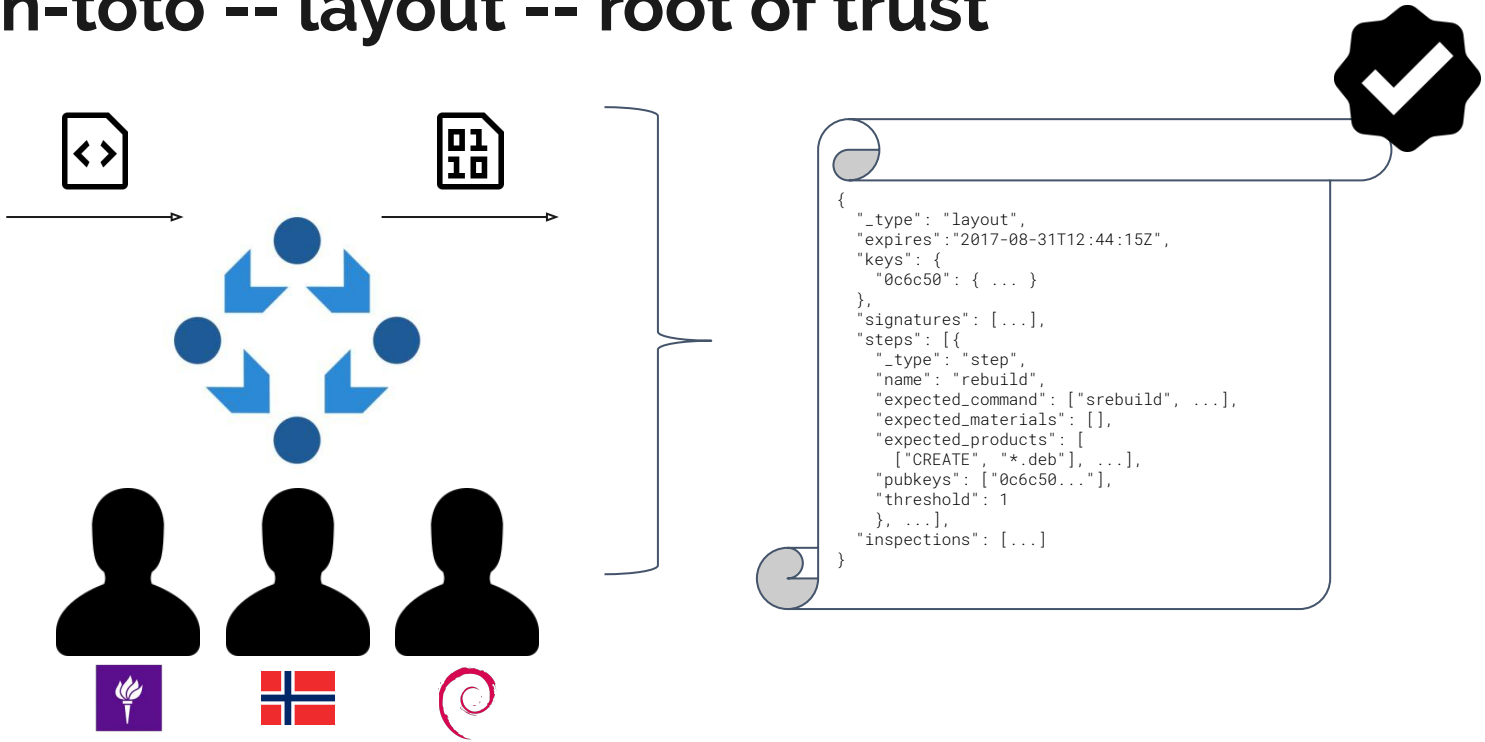
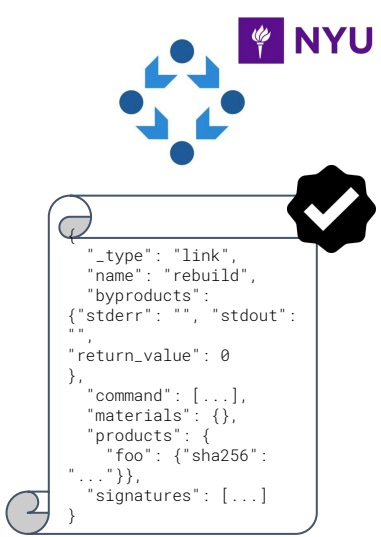
      ["CREATE", "*.deb"], ...],
    "pubkeys": ["0c6c50..."],
    "threshold": 1
    }, ...],
  "inspections": [...]
}
```

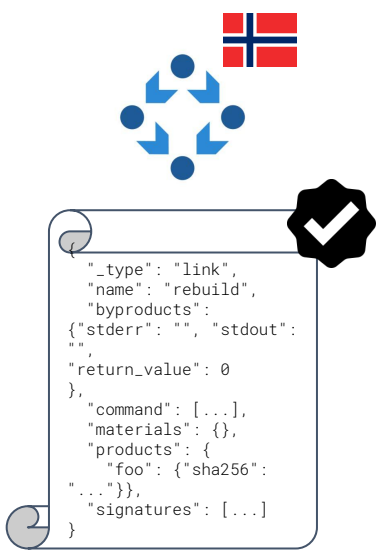
in-toto -- layout -- root of trust

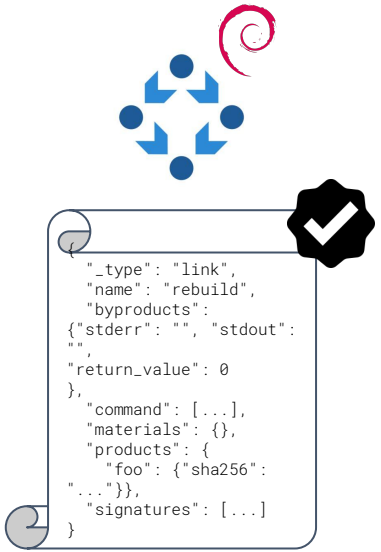


```
$ in-toto-run --key <signing key> [...] -- srebuild
```

in-toto -- signed evidence

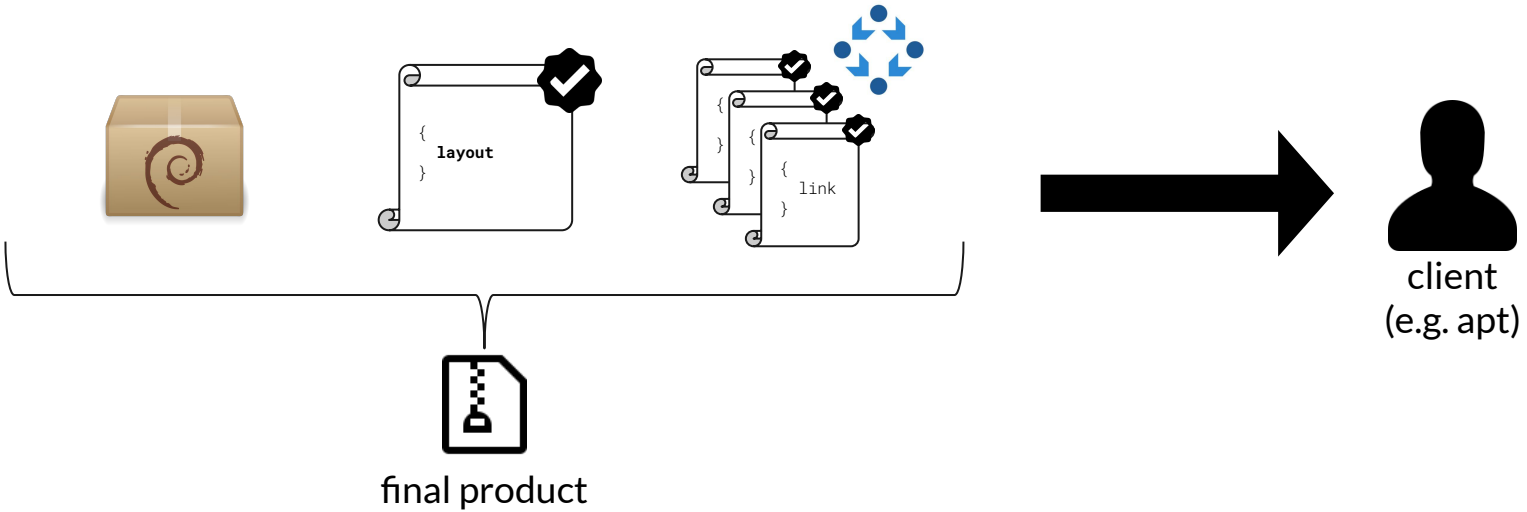






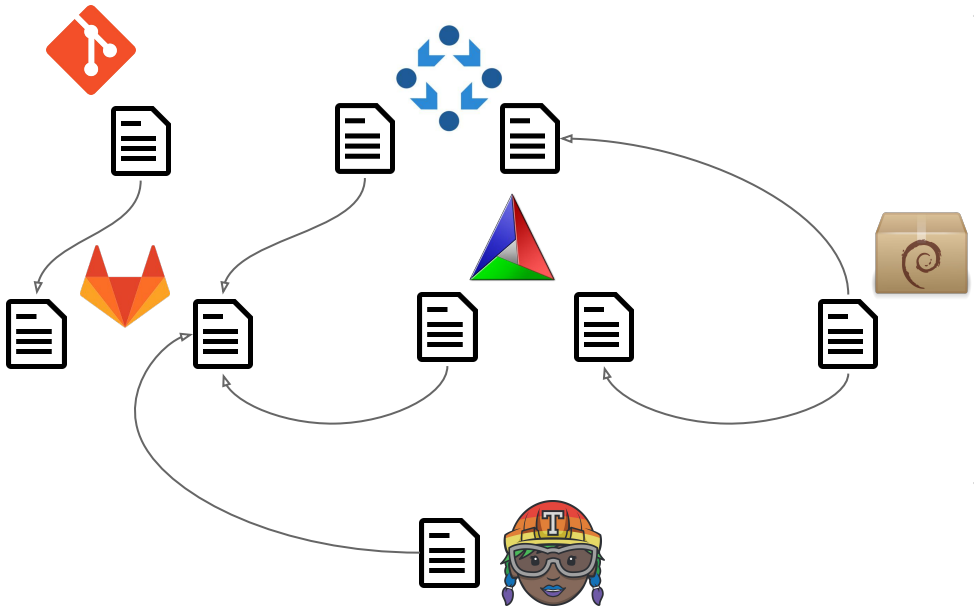
```
$ in-toto-verify --layout <layout> --key <pub key>
```

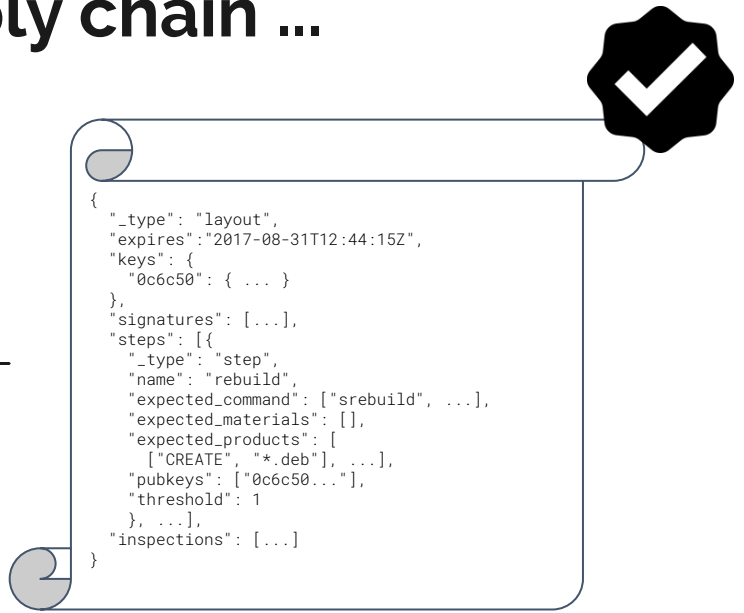
in-toto -- verification



demo

think the entire software supply chain ...





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thanks! questions?

in-toto.io

github.com/in-toto/apt-transport-in-toto

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