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Secure Firmware Update for IoT Devices

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Requirements for getting secure data

Identity

Need to ensure that the data sources are securely deployed, connected, & maintained

Integrity

Need to ensure that the data is accurate, complete and consistent

Security

Need to ensure that the transport of the data is done securely to cloud

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Remote software update is critical

- Software update is used to:
  - Fix bugs
  - Patch vulnerabilities
- Lack of security in update flow allows to:
  - Replace genuine software version with compromised software
  - Roll back software version to older version that has vulnerabilities or bugs
- As a security measure, it needs to work with secure boot & support millions of devices

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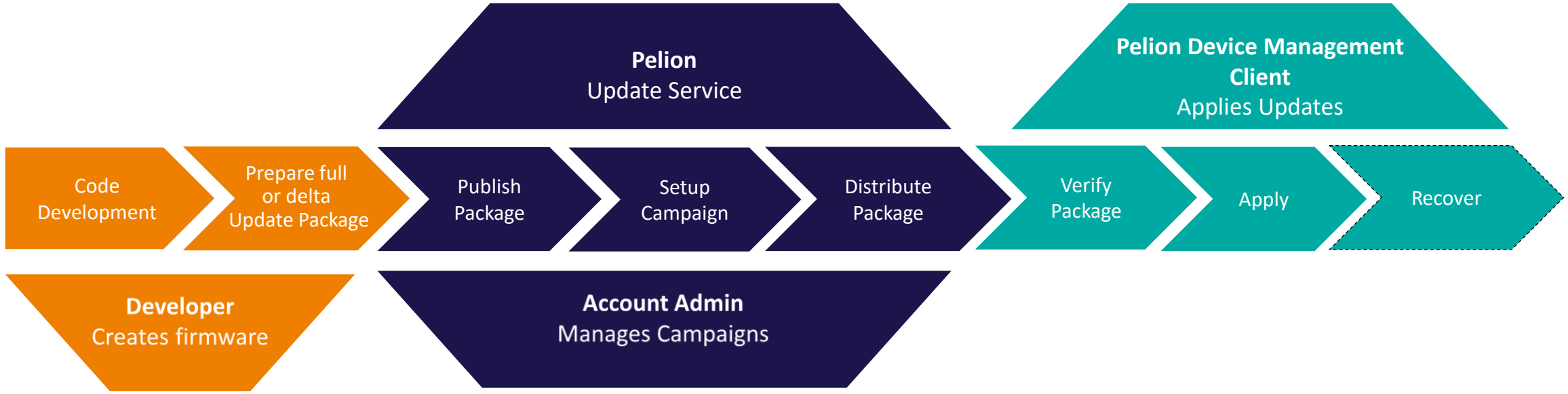
Pelion Update Service is Designed for IoT Scale



Software Developer

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Account Admin/ Service Manager

Connected Device

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Pelion Update Protections

ANTI ROLL-BACK

- Prevents installation of insecure/incompatible images
- Updates will only proceed if the version in the firmware manifest is newer than the currently installed firmware

POWER SAFE APPLICATION

- During application, the main image is checked and if corrupt the update will be re-applied
- Power failure at any time during the update will not “brick” the device.
- The device will re-apply half-completed updates on the next boot.

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Pelion Update Protections

ACCIDENT PROTECTION

- The firmware manifest describes the devices that the firmware image is built for.
- The device client inspects the manifest and rejects updates that don’t match the device.

RESUMABLE DOWNLOADS

- Sometimes power is lost before firmware has finished downloading.
- The device client can resume incomplete downloads when the power is restored.

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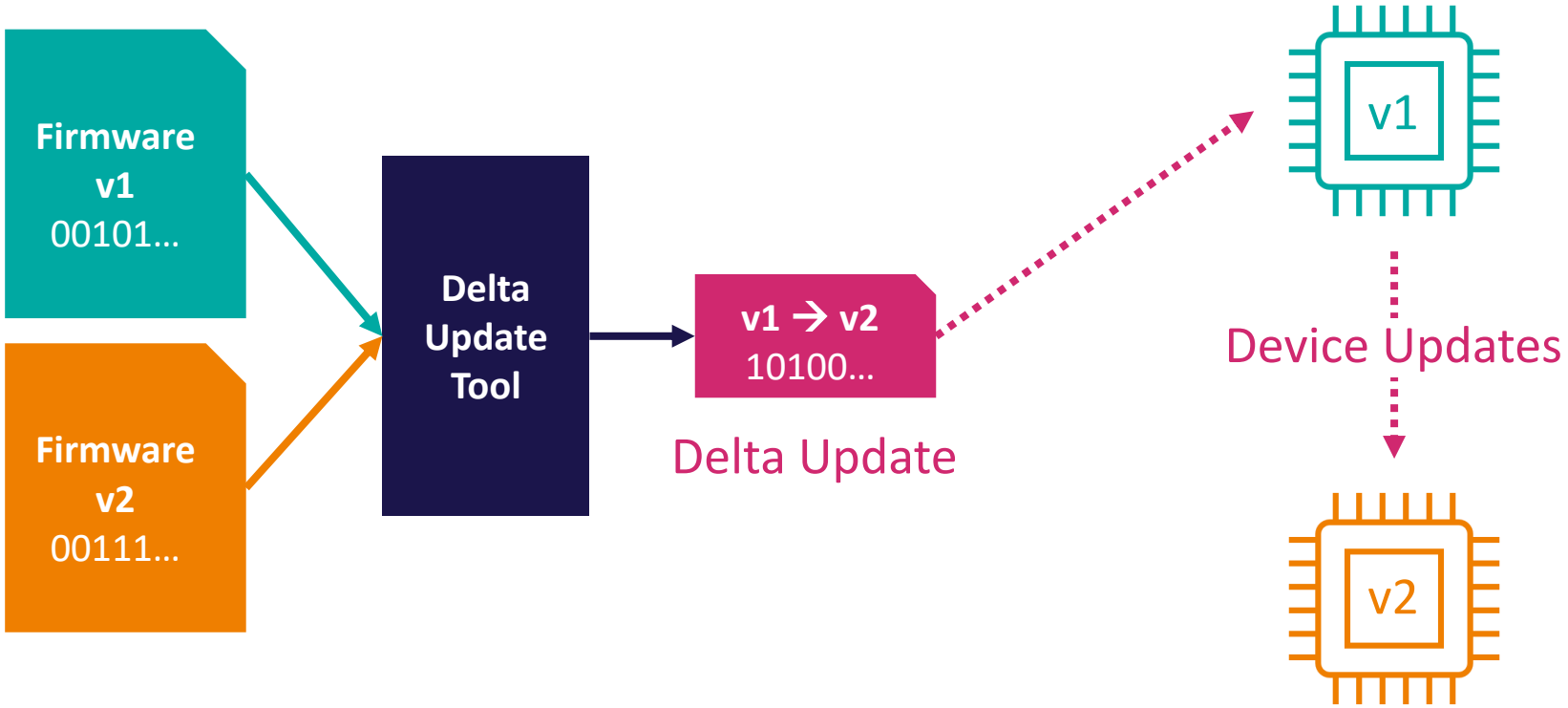
Delta Updates Reduce Bandwidth and Battery Use



- Two versions of firmware are compared for differences
- Only the “delta” is sent to the device for installation
- Large reduction in bandwidth and battery use

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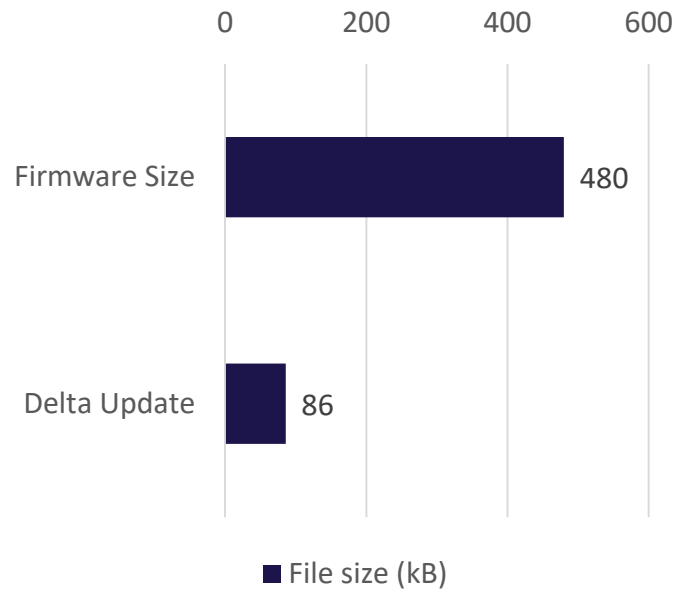
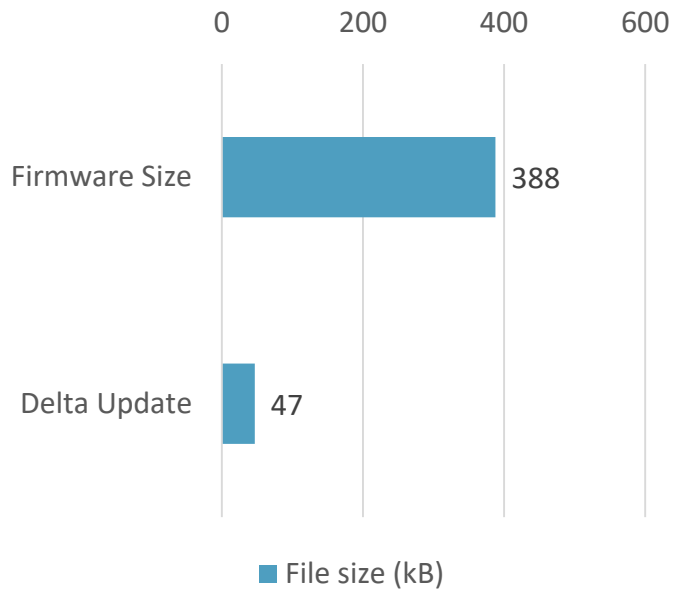
Example Delta Update Results

PDM client 2.0.0 to 2.1.0



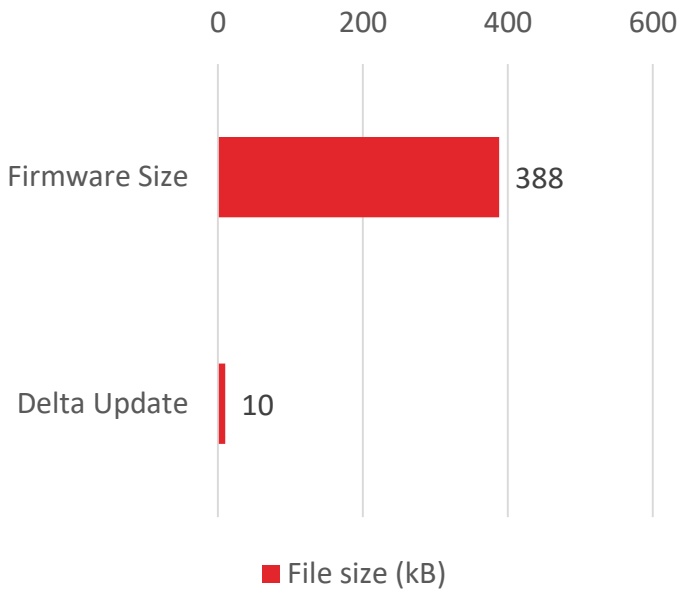
82% reduction

Adding a new driver



87% reduction

Simple string change



97% reduction

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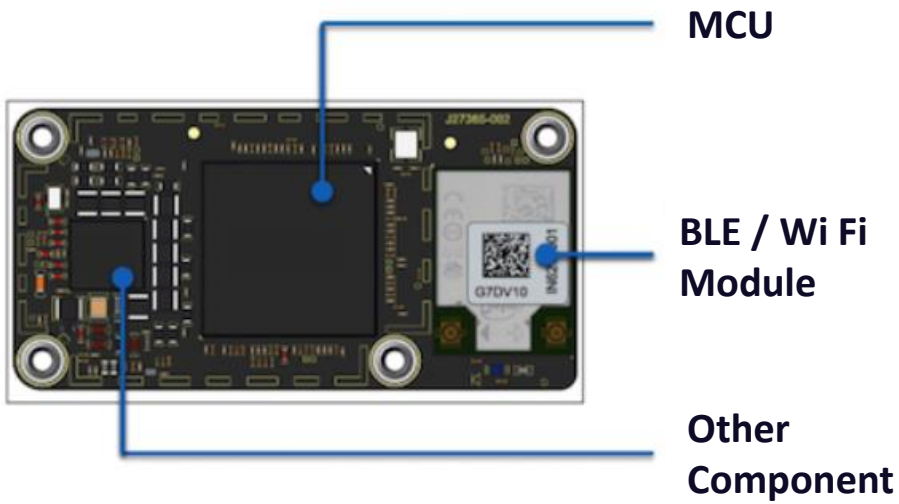
Updating Device Components

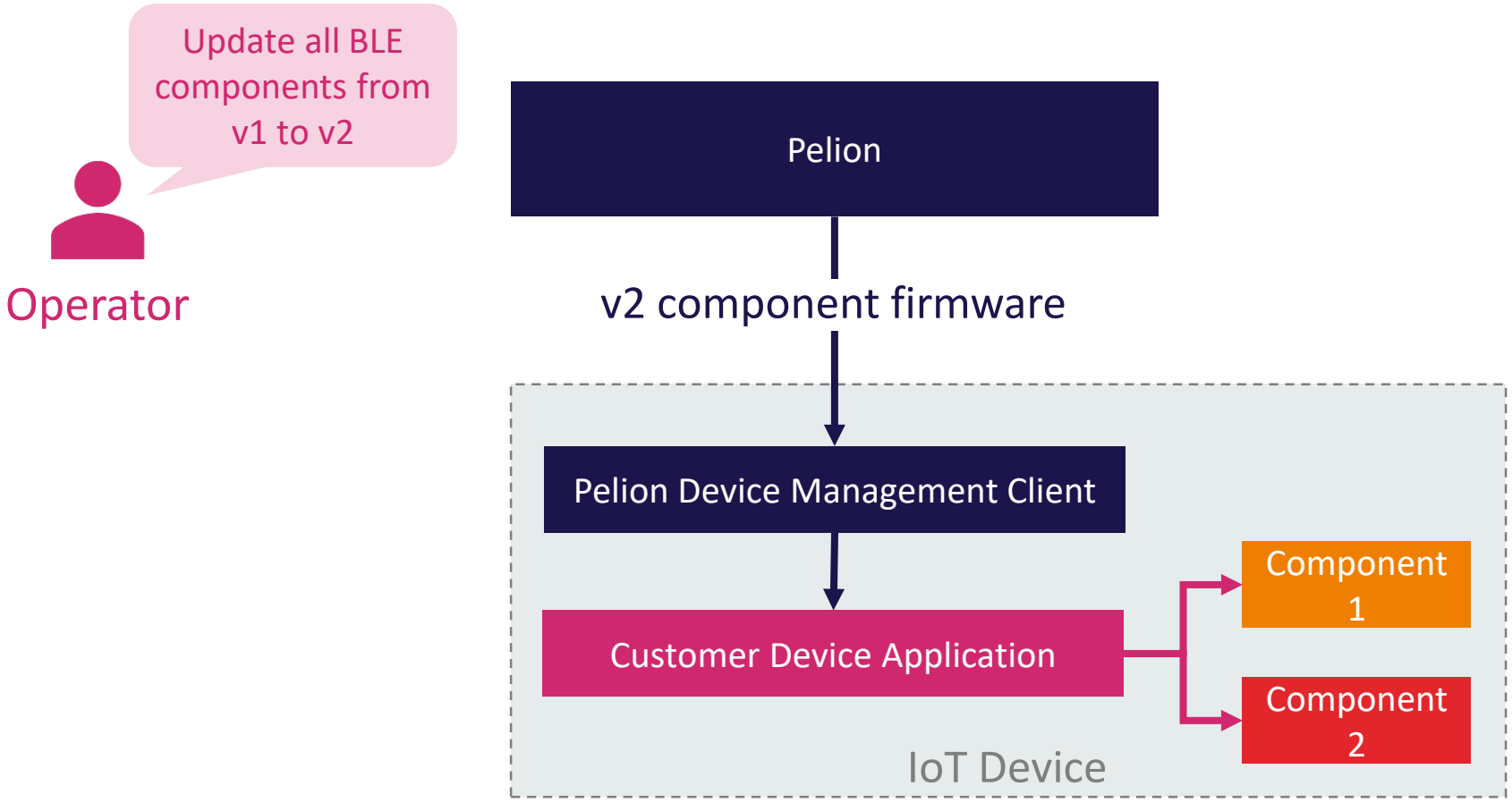
The challenge

- IoT devices may have multiple components
  - Multiple MCUs, comms modules, sensors, etc.
- These components may be provided by different manufacturers
- Each component needs continuous updates for product improvements and security fixes

A typical small IoT device



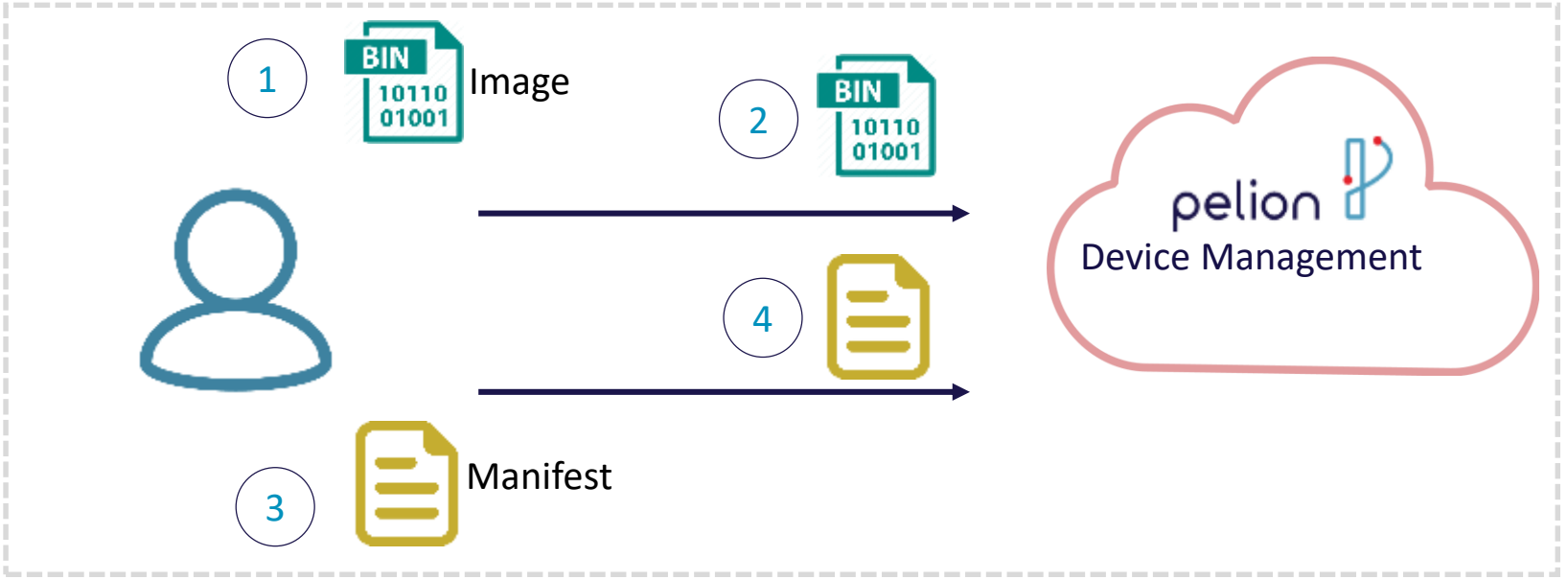
Pelion Delivers Component Firmware to Devices



- Pelion supports firmware campaigns for sub-components
- Pelion Client validates and verifies the data
- Customer app installs the component firmware

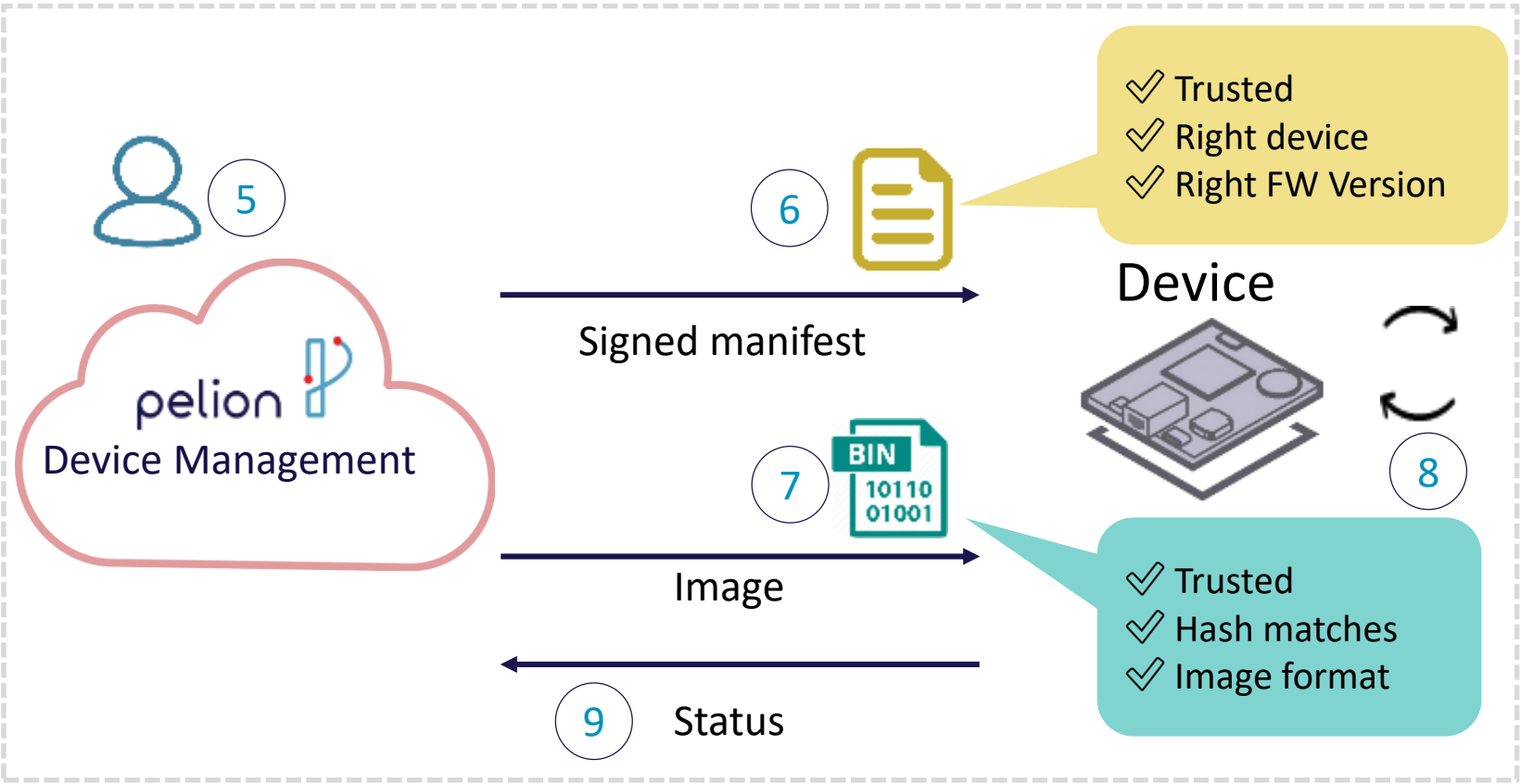
Pelion Update Flow – Creating Images

1. Build new firmware image
2. Upload image to Pelion
3. Create a manifest using the manifest tool
4. Upload the manifest to Pelion



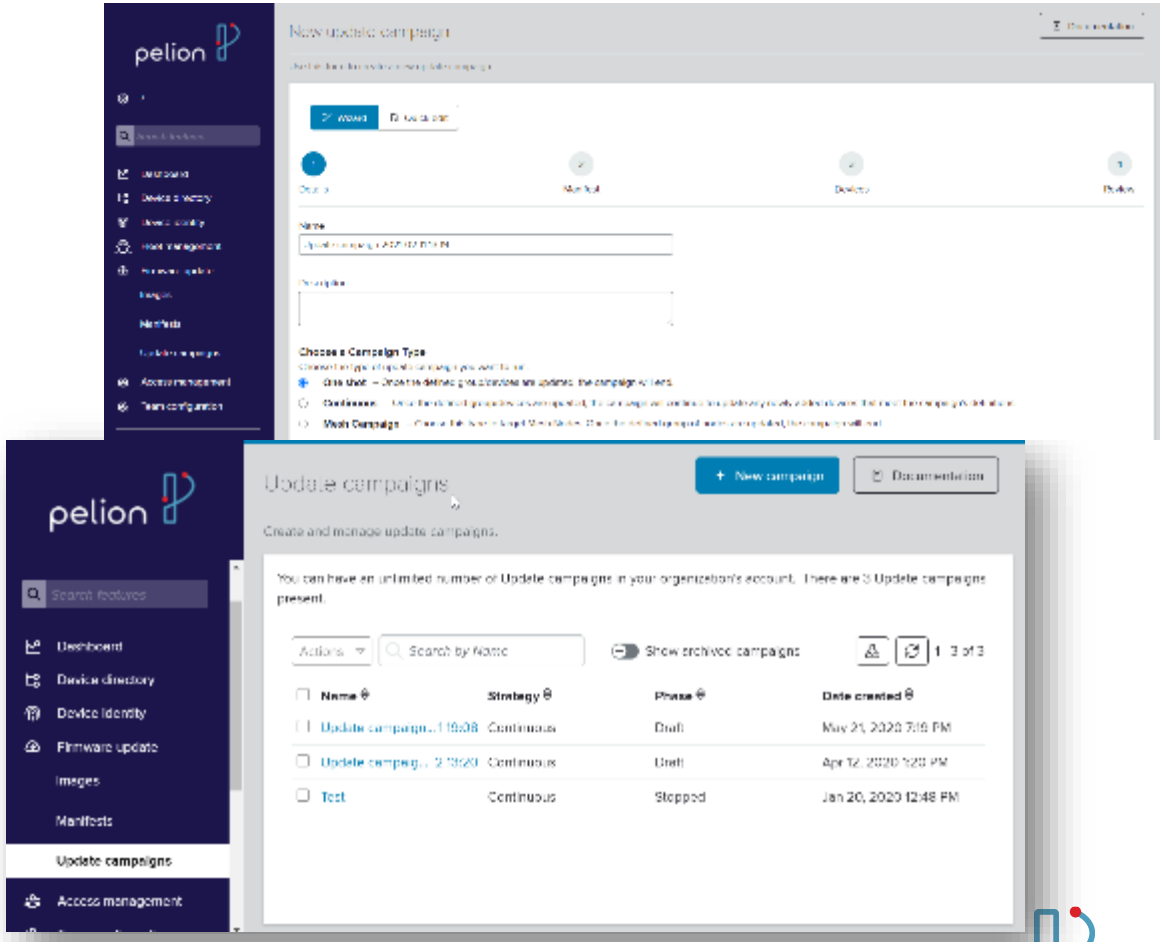
Pelion Update Flow – Deploying Updates

5. Update campaign created via Pelion Portal or API call
6. Device validates manifest
7. Device downloads image and validates
8. Device installs update
9. Device reports success



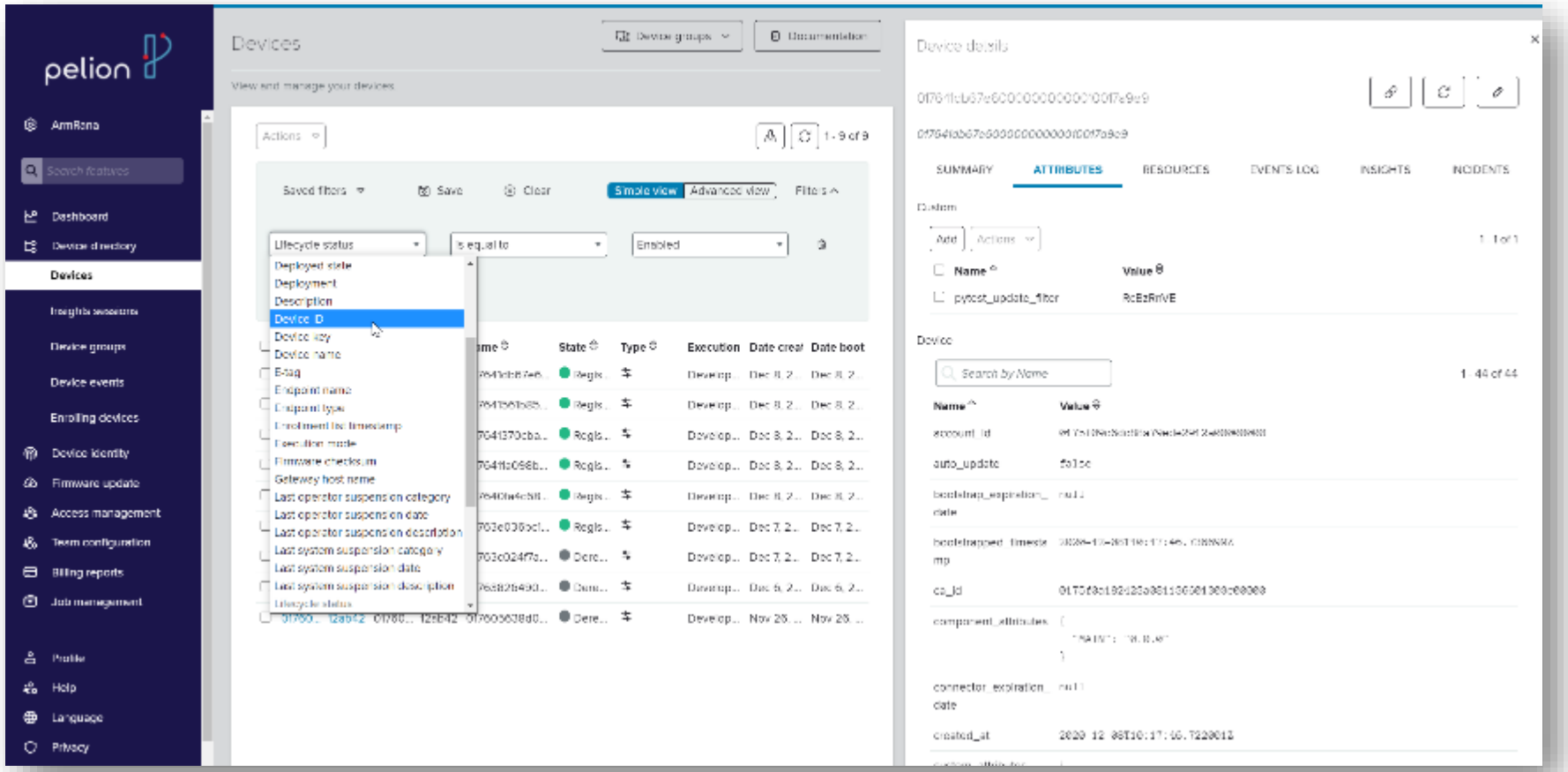
Update Campaigns

- Firmware update campaigns define which firmware to install onto a group of devices.
- Created through the web portal wizard or by using API calls.
- Powerful attribute-based filters choose which devices to target.
- Operators can see update campaign statistics in the portal.



Device attributes and filters

- Built-in attributes
  - Provided by Pelion.
  - Manufacturer, serial number, device type, etc.
- Custom attributes
  - Provided by you.
  - Arbitrary data that is appropriate to your domain.



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Continuous vs One-Shot Campaigns

One-Shot

- A one-shot campaign performs **one search** to find devices that match the filter.
- The matching devices are updated.
- New devices are ignored.

Continuous

- Continuous campaigns **keep searching** for devices that match the filter.
- Whenever a match is found, an update is triggered.
- Useful for updating devices when they first connect.

E.g. “*update any device where version < 3.7*”.

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Thank You
Obrigado
Merci
谢谢
ありがとう
Gracias
Kiitos
감사합니다
धन्यवाद
شكرًا
תודה