Cloudvue

Integration Overview – SDK/API

Johnson Controls

Cloudvue Platform

EMBEDDED SDK

- Support wide array of devices

EXTENSIVE CLOUD API & SERVICES

- Scalable and extensible cloud services
- Manages devices, network, bandwidth, users, events, schedules, etc.
- Data Storage
- Cyber Security and GDPR compliance
- System Dashboard
- Analytics and Notifications
- OTA Updates

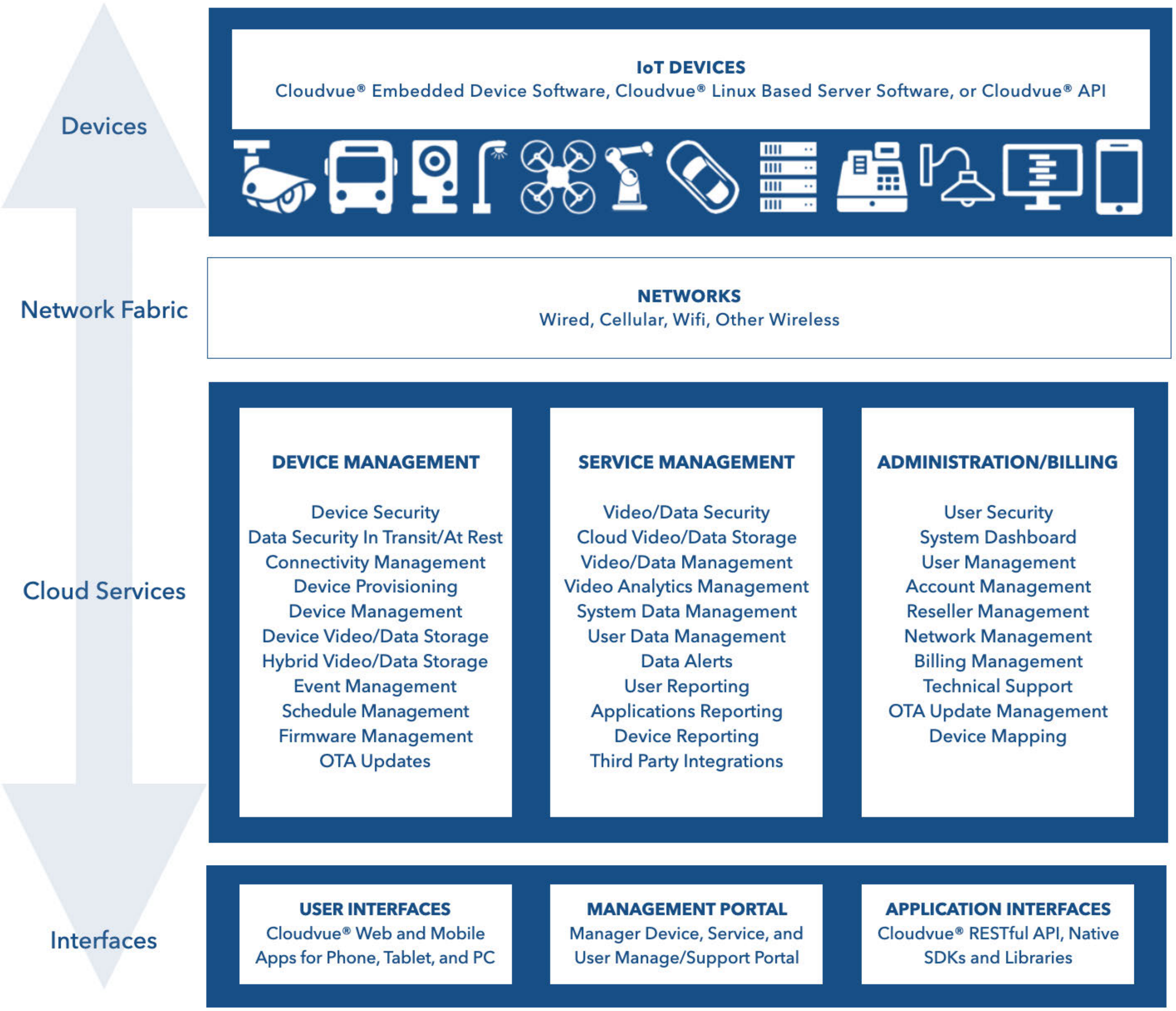
INTUITIVE USER INTERFACE

- No plugin, no custom networking, accessible everywhere on any device
- Can be embedded (iOS/Android/Web SDK) and white-labeled

HOSTED ON MICROSOFT AZURE

- Available in 140 countries
- Designed to work with other cloud providers (AWS, GCP, etc)

Platform Overview



Devices

Network Fabric

Cloud Services

Interfaces

IoT DEVICES
Cloudvue® Embedded Device Software, Cloudvue® Linux Based Server Software, or Cloudvue® API

NETWORKS
Wired, Cellular, Wifi, Other Wireless

DEVICE MANAGEMENT

Device Security
Data Security In Transit/At Rest
Connectivity Management
Device Provisioning
Device Management
Device Video/Data Storage
Hybrid Video/Data Storage
Event Management
Schedule Management
Firmware Management
OTA Updates

SERVICE MANAGEMENT

Video/Data Security
Cloud Video/Data Storage
Video/Data Management
Video Analytics Management
System Data Management
User Data Management
Data Alerts
User Reporting
Applications Reporting
Device Reporting
Third Party Integrations

ADMINISTRATION/BILLING

User Security
System Dashboard
User Management
Account Management
Reseller Management
Network Management
Billing Management
Technical Support
OTA Update Management
Device Mapping

USER INTERFACES
Cloudvue® Web and Mobile
Apps for Phone, Tablet, and PC

MANAGEMENT PORTAL
Manager Device, Service, and
User Manage/Support Portal

APPLICATION INTERFACES
Cloudvue® RESTful API, Native
SDKs and Libraries

Embedded SDK

- Static/Dynamic library written in C++11
- Multi-OS (32-bit and 64-bit) support (Windows, Mac, Linux)
- Few dependencies: websockets, TLS 1.2+, curl and JSON
- Lightweight (<400 KB, <1.7 MB for external libs)
- Manages secure device communication with Cloudvue
- Automatic or on-demand OTA updates
- Generic device interfaces
- Real-time streaming interface for events and data
- Cloud archiving and storage

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Using the embedded SDK

Link against static/dynamic library

Initialize cloud connections and handle connect/disconnect errors

```
static bool connect(const CloudConnect& data,
std::function<void(void)> connect_callback,
std::function<void(void)> disconnect_callback,
const std::list<std::string>& device_ids);
```

Register handlers for device capabilities

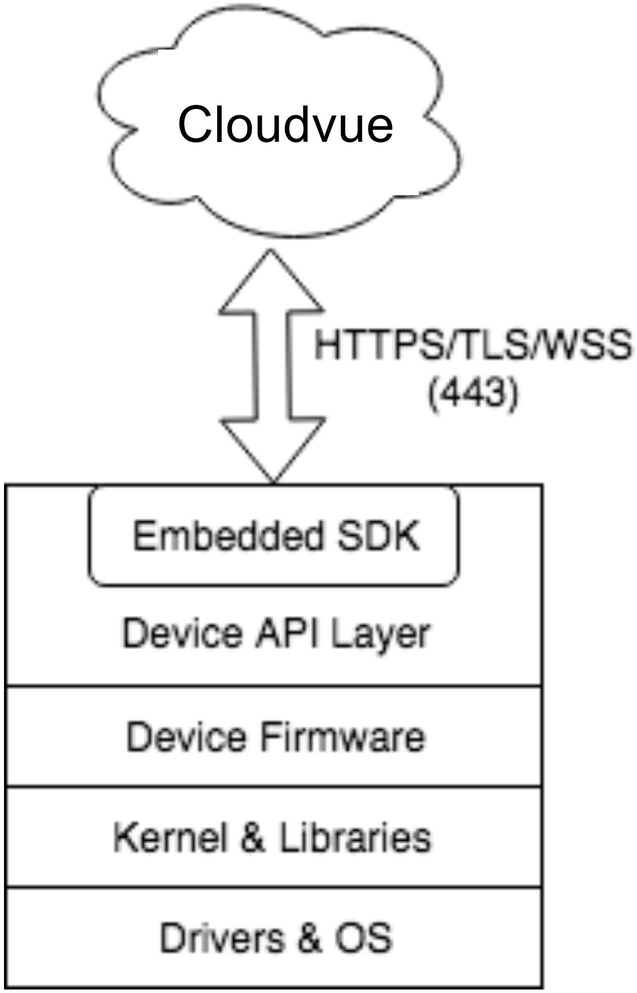
```
static void register_list_actions
(std::function<MsgResponse(std::string)> handler);
static void register_perform_action
(std::function<MsgResponse(ActionInfo)> handler);
```

Register OTA update handler

```
static void register_ota_update
(std::function<MsgResponse(UpdateInfo)> handler);
```

Call SDK methods to send data

```
static void upload_clip(const ClipInfo& info);
static void upload_event(const EventInfo& info);
```



Cloudvue

HTTPS/TLS/WSS
(443)

Embedded SDK

Device API Layer

Device Firmware

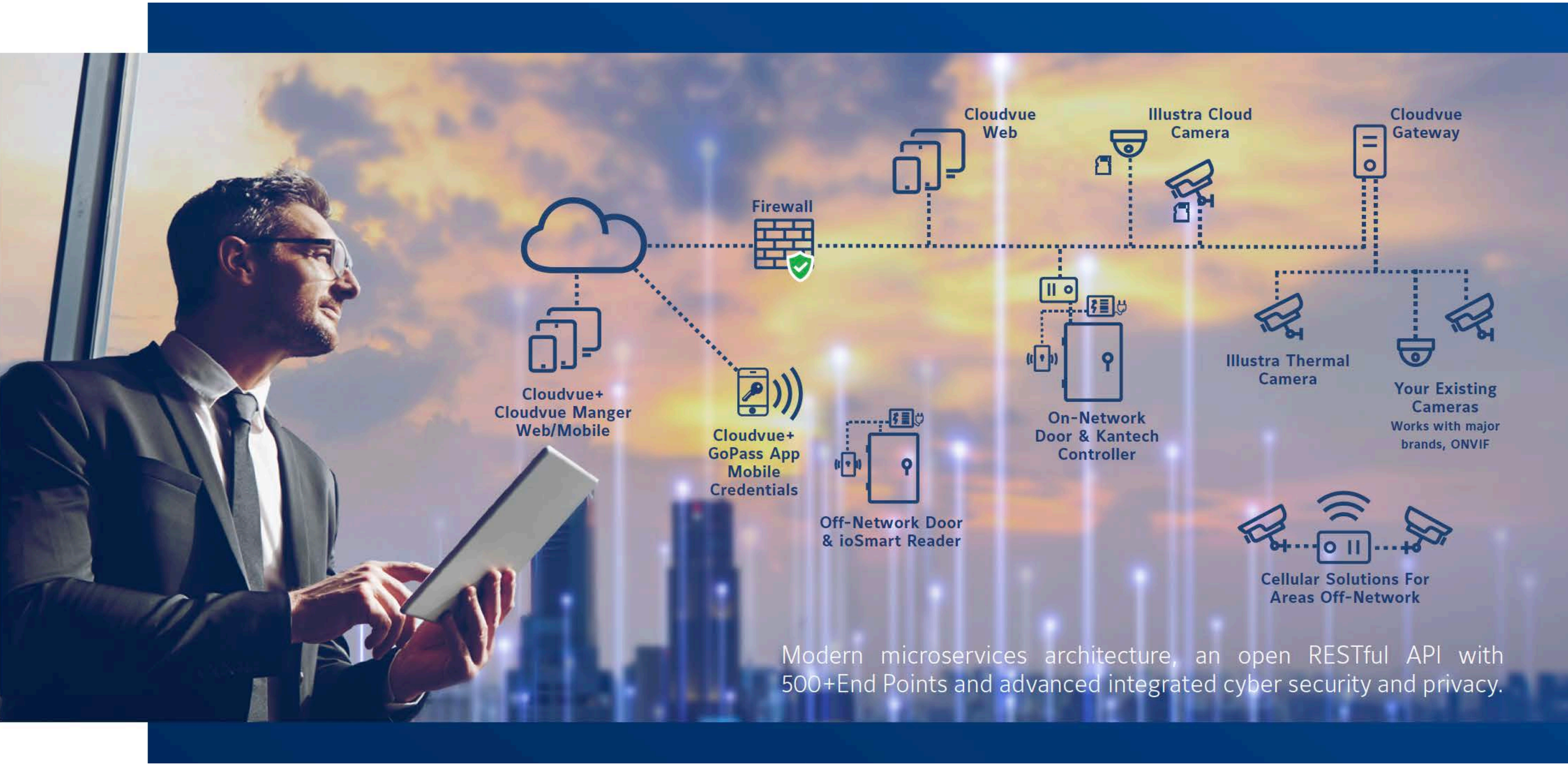
Kernel & Libraries

Drivers & OS

Device API Layer

- Abstraction layer between device firmware and embedded SDK
- Responsible for initializing the embedded SDK
- Error handling with retries and timeout
- Provide information about supported actions on the device (and/or sub-devices)
  - e.g. ”get_light_state”, “set_light_state” (on/off), “set_brightness”
- Invoke hardware method to perform requested action
  - e.g. Set the brightness level on a light bulb
- Support actions for sub-devices
  - e.g. Send command to NVR (gateway device) to change camera (sub-device) resolution

Cloud Architecture


Cloudvue Web
Illustra Cloud Camera
Cloudvue Gateway
Firewall
Cloudvue+ Cloudvue Manger Web/Mobile
Cloudvue+ GoPass App Mobile Credentials
Off-Network Door & ioSmart Reader
On-Network Door & Kantech Controller
Illustra Thermal Camera
Your Existing Cameras
Works with major brands, ONVIF
Cellular Solutions For Areas Off-Network

Modern microservices architecture, an open RESTful API with 500+End Points and advanced integrated cyber security and privacy.

Cloud API & Services

Robust Cloud API and services

- Many domain objects (devices, users, events, schedules, settings, alerts)
  - Can define new objects as needed
- Billing & Provisioning & Analytics
- Extensible

Simple to integrate

- Online Interactive Guide*
- Well documented
- Client SDKs* (Swift for iOS; Java for Android, JS for Web)

Generic device APIs

- List device actions
- Perform device action (can also be used to retrieve information)
- OTA updates

* See references and sample code in Appendix

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Cloud API: Get device actions

Use this GET endpoint to retrieve device (and/or sub-devices) supported actions

```
https://<env>-gateway.cloudvue.com/v1/<app_id>/nvrs/<device_id>/utility/actions
[?device=<sub_device>]
```

Sample response:

```
{ "status": 200,
  "delay": 2582,
  "message": {
    ”device": [],
    ”subdevices": [
      { "mac_address": "ACCC8E8737E1",
        "actions": [
          {
            "action": "play_audio",
            "type": "Object",
            "description": "Play audio on the speaker. Value should be an
object specifying the type. Available types are:\n - \"file\": play from a
file. Data in the file should be raw binary G711 audio. Have to specify
\"path\" in the value object.\n - \"data\": play audio data given in field
\"data\", base64 encoded."
          }
        ]
      }
    ]}}
```

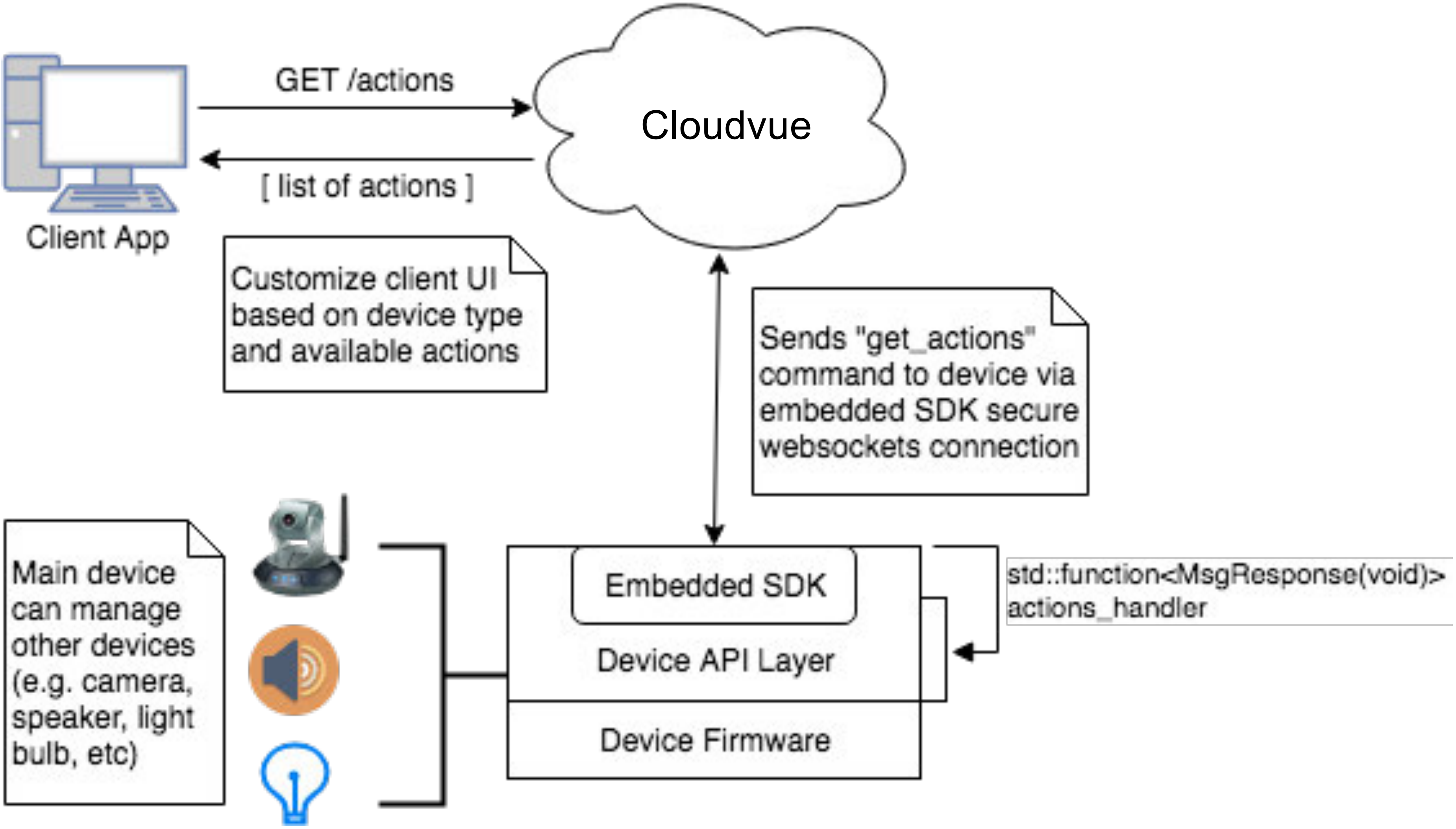
Cloud API: Perform device action

Use this POST endpoint to perform device action

```
https://<env>-gateway.cloudvue.com/v1/<app_id>/nvrs/<device_id>/utility/action
```

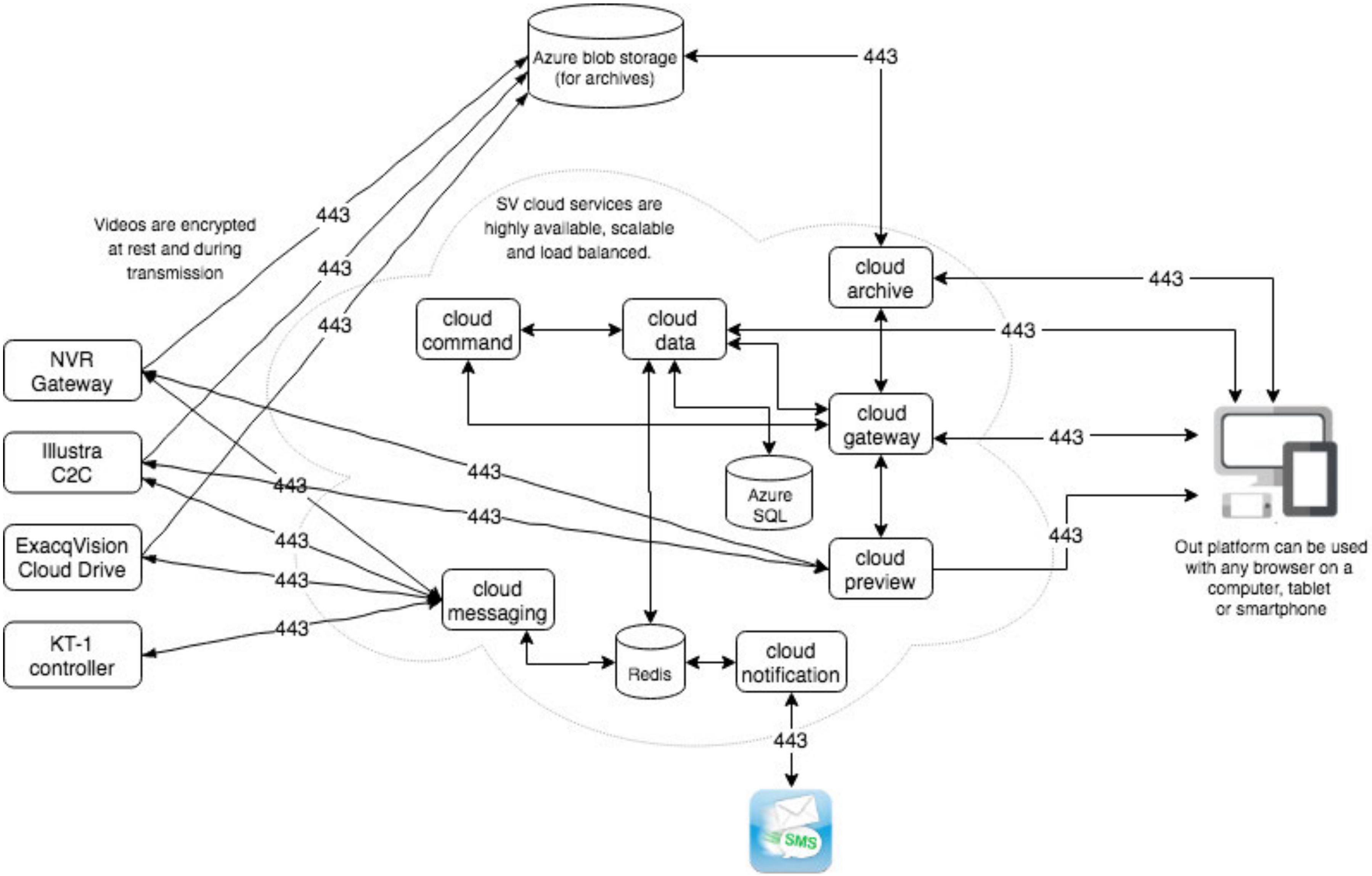
Field	Required	Type	Description
device_id	Yes	Number	Unique ID of the device
action	Yes	String	Action name
value	Optional	Object	Value the action should receive
device	Optional	String	Unique ID of sub-device on which to perform the action. By default, perform action on the main device.

Actions Component Diagram



Client App
GET /actions
[list of actions]
Cloudvue
Customize client UI based on device type and available actions
Sends "get_actions" command to device via embedded SDK secure websockets connection
Main device can manage other devices (e.g. camera, speaker, light bulb, etc)
Embedded SDK
Device API Layer
Device Firmware
std::function<MsgResponse(void)> actions_handler

Data Flow Diagram


Azure blob storage (for archives)
443
Videos are encrypted at rest and during transmission
SV cloud services are highly available, scalable and load balanced.
443
443
443
cloud archive
443
cloud command
cloud data
443
NVR Gateway
cloud gateway
443
Illustra C2C
443
443
Azure SQL
443
ExacqVision Cloud Drive
443
443
cloud preview
443
Out platform can be used with any browser on a computer, tablet or smartphone
cloud messaging
KT-1 controller
443
Redis
cloud notification
443
SMS

Events and Data Stream

- Events are primarily detected on the device, but can be generated from external sources (e.g. POS integration)
- Events are propagated in real-time (ms latency)
- Events can trigger other event types
  - e.g. Start camera recording when door is unlocked
  - Rules can be defined in the rules engine
- Events can send alert notifications
  - e.g. Notify “security” for fraudulent event
  - Users can configure schedule for alerts (e.g. notify after hours)
- Support external event processing via URL callback
- Client applications can subscribe to event/data stream via custom channels*
  - e.g. Show live camera stream

* See references and sample code in Appendix

External event processing

Use this POST endpoint to configure external event processing

```
https://<env>-gateway.cloudvue.com/v1/<app_id>/nvrs/<device_id>/alerts
```

Field	Required	Type	Description
device_id	Yes	Number	Unique ID of the device
alert_type_id	Yes	Number	Alert type ID associated with the event
name	Yes	String	Display name of the alert
start_at	Yes	Date	ISO string of start time of alert (HH:MM:SS)
end_at	Yes	Date	ISO string of end time of alert (HH:MM:SS)
url	**Optional**	**String**	**Callback URL that will be POSTed on alert**
attach_image	Optional	Boolean	Attach image snapshot for the event
days	Optional	String	Bitstrings of days enabled, where format is SMTWTFS

Rules Engine

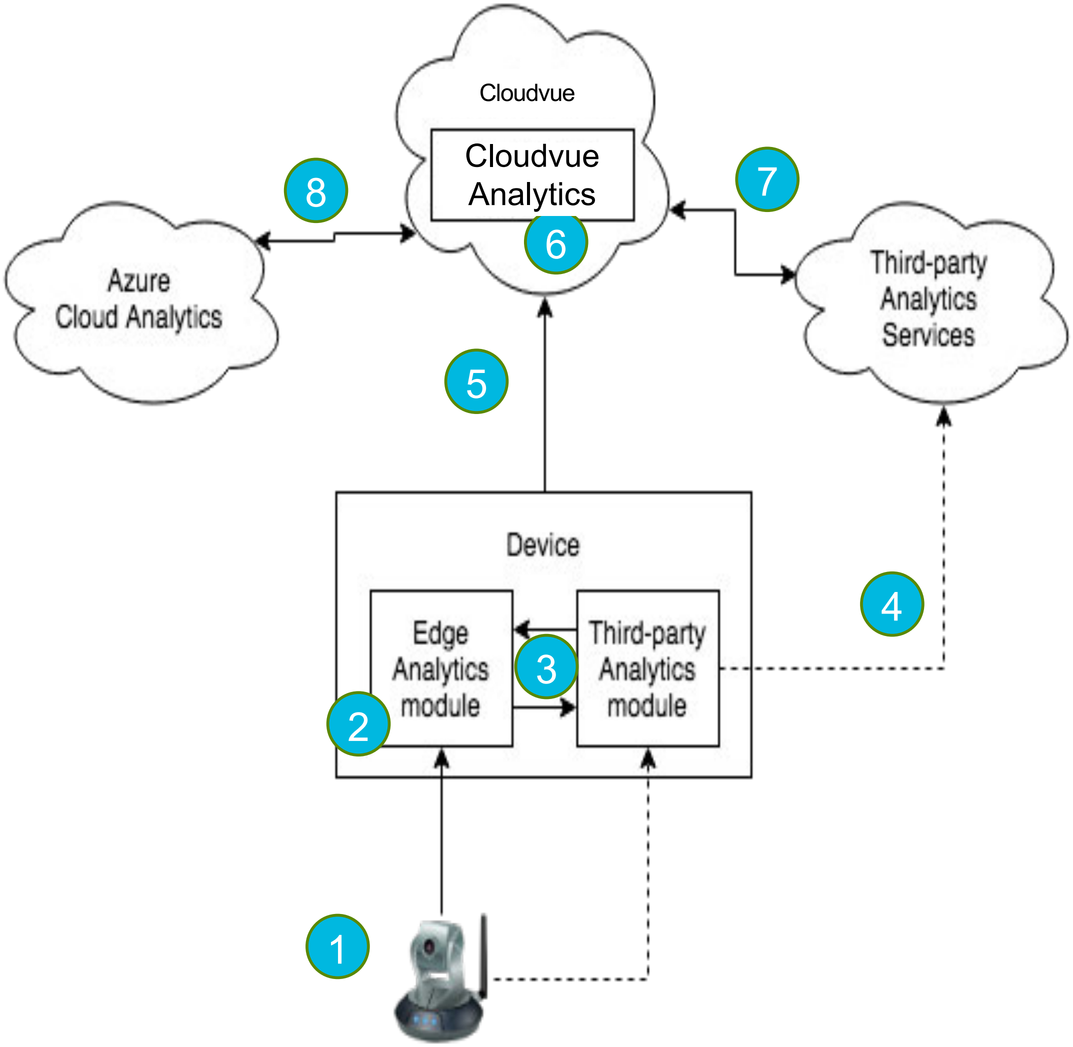
- Defines M:N (many-to-many) relationship between events and corresponding actions
- Event can trigger one or more actions.
- Can combine events to generate a new event type
  - e.g. Trigger ”fraudulent” event when multiple ”entry” events using a single card
- Standard yet extensible JSON format*
- Each product group defines their own rules, in collaboration with other product groups on supported device actions.
- Rules are loaded at run-time.

Sample rule

```
{ "devices": [
   { "id": "POWERG_1",
     "deviceId": 1,
     "deviceType": "POWERG",
     "type": "door",
     "name": "Door A",
     "actionList": [ {
        "state": "open",
        "target": { "id": "0050F9F9696D”, ... },
        "action": {
          "name": "record",
          "type": "RECORD",
          "description": "Start recording on Camera 1 when Door A is opened",
          "options": {
            "cancel": false,
            "duration": 30
          }
        }
      },
      ...
     ]
   },
   ...
  ]
}
```

Analytics Integration

1. Sensor (e.g. camera) sends data (e.g. video/image) stream and may also detect relevant activities (e.g. motion).
2. Edge analytics module extracts events from data (e.g. video) stream.
3. Support integration with third-party analytics module embedded on the device.
4. Third-party embedded module may communicate with third-party analytics services in the cloud.
5. Device then forwards data and analytics events to Tyco cloud services.
6. Perform additional processing in the cloud.
7. Can optionally leverage third-party analytics cloud services;
8. Or leverage Microsoft Azure analytics e.g. Azure Computer Vision API.



Appendix - References

CLOUD API

- https://gateway.cloudvue.com/docs/

CLOUD WEB INTERFACE

- https://www.cloudvue.com/

CLOUD MANAGER INTERFACE

- https://dashboard.cloudvue.com/

WEB CLIENT EXAMPLE

- https://www.cloudvue.io/s/Cloudvue-API-Web-Client-Example.zip