# Software-defined IoT Cloud Systems


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## Software-defined elastic IoT Cloud

### Vision

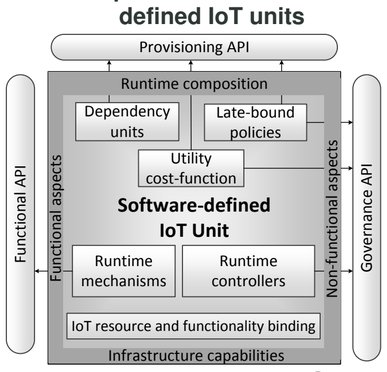
- Virtualizing and pooling IoT cloud resources and capabilities of IoT infrastructure.
- Encapsulating fine-grained IoT resources and IoT capabilities in well-defined API.
- Providing an ecosystem for software-defined IoT cloud to support multitude of involved stakeholders.
- Automating provisioning and governance of IoT cloud systems.
- Enabling new types of cross-domain applications in future smart cities.

### Novel Models and Techniques

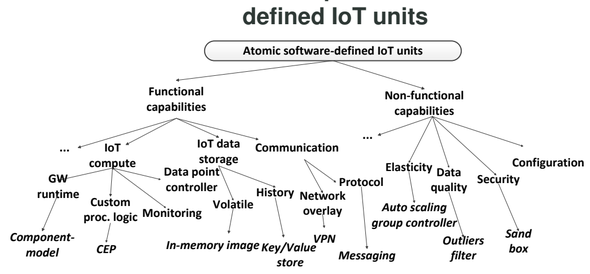
- Software-defined IoT units.
- Software-defined gateway enables cloud connectivity, exposes data/control points and provides an execution environment for IoT units.
- A tool-suit for provisioning and runtime governance of software-defined IoT cloud systems.
- A programing model for the software-defined cloud-scale applications.
- IoT marketplace for IoT units and IoT artifacts.

## 1. Software-defined IoT units

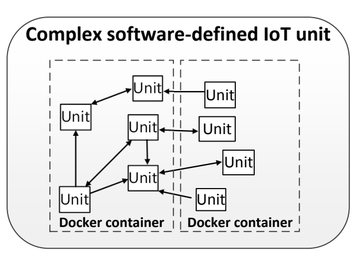
**Conceptual model of software-defined IoT units**




**Different examples of software-defined IoT units**

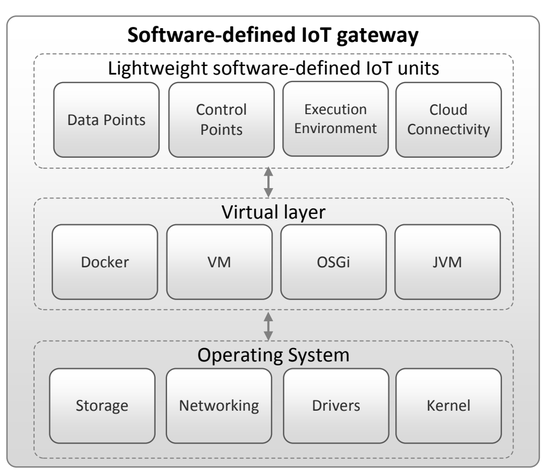



**Complex software-defined IoT unit**

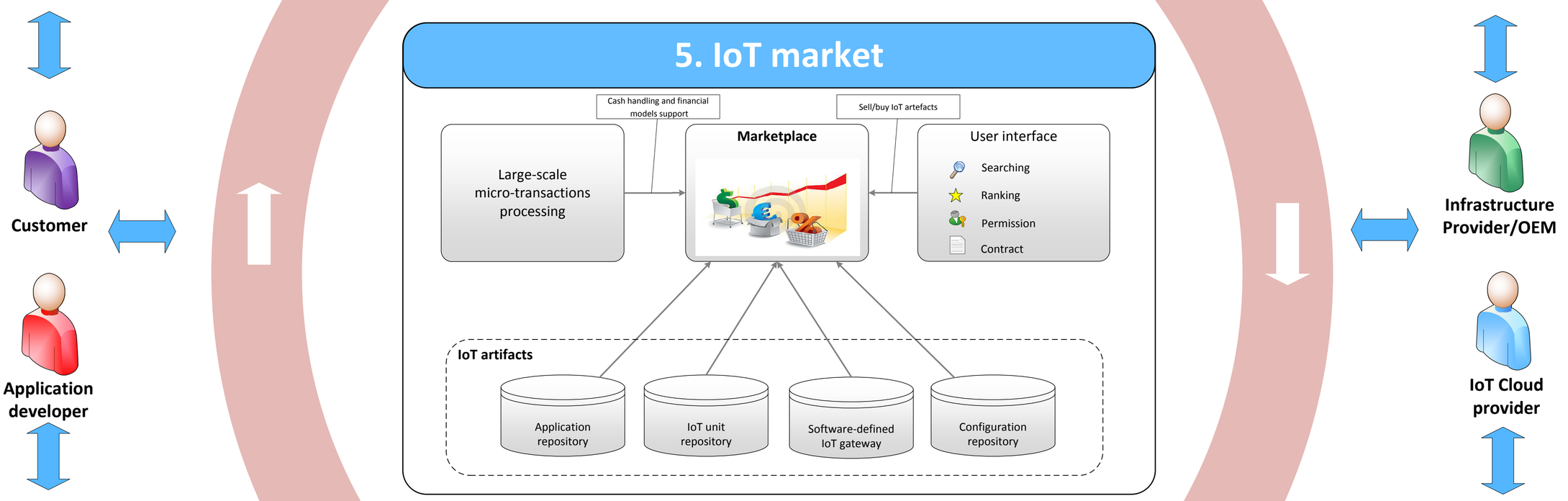



- Fine-grained encapsulation of IoT resources and IoT capabilities
- Software-defined API
- Support for DevOps principles
- Policy-based managed configuration
- Cost-awareness

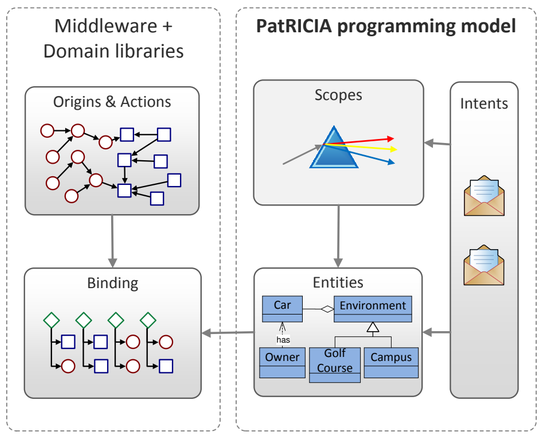
## 2. Software-defined IoT gateway




- Enabling flexible customization of IoT resources and end-devices (e.g, gateways)
- Run-time modifications (e.g, of communication protocols)
- Code distribution
- Location-aware migrations
- Enchasing end-devices with reliability, availability, data quality, etc., aspects
- Fine-grained configuration of IoT capabilities

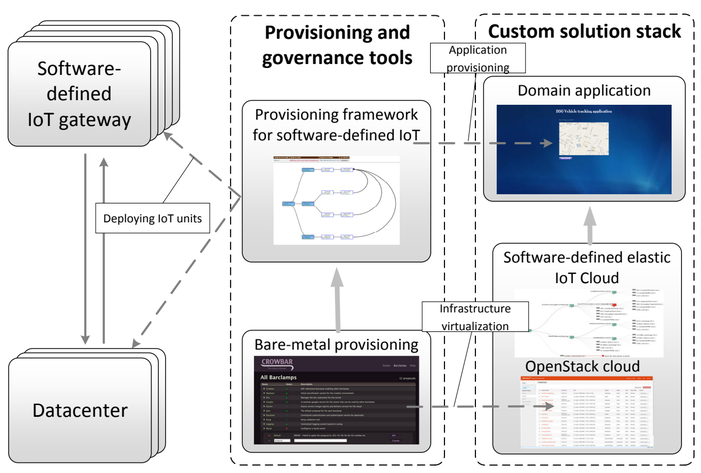



## 4. Application development support




- Scalability of programing enabled by Scopes
- Efficient development with an intuitive Intent-based approach
- Abstracting low-level processes with Domain libraries
- Environment agnostic applications based on Origins and Actions
- Reusable applications
- Loose coupling due to runtime binding of Entities with physical environments
- Support for multitude of developers (e.g., domain experts and high-level programmers)

## 3. Provisioning and governance




- Automated IoT unit deployment based on TOSCA and SALSA
- Automated IoT unit composition
- Managed configuration based on Chef recipes
- Provisioning with late-bound policies
- Runtime governance
- Elastic operations and DevOps principles
- Enforcement of non-functional properties (e.g, reliability, availability, etc.) with plug-in controllers


References

1. Stefan Nastic, Sanjin Sehic, Le-Duc Hung, Hong-Linh Truong, and Schahram Dustdar. Provisioning Software-defined IoT Systems in the Cloud. The 2nd International Conference on Future Internet of Things and Cloud (FiCloud-2014), August 27-29, 2014, Barcelona, Spain.
2. Stefan Nastic, Sanjin Sehic, Michael Vögler, Hong-Linh Truong, and Schahram Dustdar. PatRICIA - a Novel Programming Model for IoT Applications on Cloud Platforms. International Conference on Service Oriented Computing and Applications (SOCA 2013), December 16-18, 2013, Hawaii, USA.
3. Sanjin Sehic, Stefan Nastic, Michael Vögler, Fei Li, and Schahram Dustdar. Entity-Adaptation: A Programming Model for Development of Context-Aware Applications. Symposium On Applied Computing (SAC 2014), March 24-28, 2014, Gyeongju, Republic of Korea.