Architecture Approach
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- **IoT reference architectures**
  - AIOTI - Reference Architecture
  - ISO/IEC 30141 IoT Reference Architecture
  - ITU-T Y.2060
  - IOT-A ARM

- **Architecture patterns**
  - Four-tier architecture
  - Gateway-mediated and direct cloud connectivity
  - Connectivity and management
  - Device-to-Cloud
  - Multi-tier data storage
  - Distributed analytics

- **Characteristic features of IoT**
  - Data correlation and information retrieval
  - Communication
  - Integration and interoperability
  - Security, privacy and trust
Architecture Approach

- 3D Reference IoT Architecture
- Objectives:
  - Ensure that the model deals with
    - All the functional aspects, in particular “cross layers”
    - More than the functional aspects
  - Explain how it can be mapped on other reference architectures
- Main aspects
  - A three dimensional model
    - Layers
    - Cross-cutting functions
    - Properties
  - Addressing more explicitly some expected properties of the system
# Architecture Approach

## IoT Architectural Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Layer</strong></td>
<td>vehicle sensors, vehicle actuators, infrastructure cameras, IoT devices, vehicle cameras</td>
</tr>
<tr>
<td><strong>Processing Layer</strong></td>
<td>RSU processing, local processing, gateway processing</td>
</tr>
<tr>
<td><strong>Storage Layer</strong></td>
<td>storage/database</td>
</tr>
<tr>
<td><strong>Abstraction Layer</strong></td>
<td>common data model, event and action management</td>
</tr>
<tr>
<td><strong>Service Layer</strong></td>
<td>application enablement, device management, service orchestration, context management</td>
</tr>
<tr>
<td><strong>Application Layer</strong></td>
<td>visualization/dashboard, development environment, traffic light assist, car rebalancing, data analytics</td>
</tr>
<tr>
<td><strong>Collab. &amp; Proc. Layer</strong></td>
<td>cross pilot collaboration, business system integration</td>
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</tbody>
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## Architecture Approach

### IoT Architectural Layers

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<tr>
<th>Layer</th>
<th>IoT Cross-cutting Functions</th>
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<tr>
<td>Collaboration and Processes Layer</td>
<td>Application management, Device Management</td>
</tr>
<tr>
<td>Application Layer</td>
<td>Identification, Authorization</td>
</tr>
<tr>
<td>Service Layer</td>
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<td>Processing Layer</td>
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<tr>
<td>Network Communication Layer</td>
<td>Identification, Authorization</td>
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<td>Physical Layer</td>
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</tr>
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Architecture Approach
Versailles pilot site - Urban driving

IoT Applications
Connected and automated driving with point of interest notifications (audio/video) and VRU detection (collaborative perception).

IoT Platforms and Software
oneM2M.

IoT Technologies and Standards
oneM2M; 4G/LTE; PEXSI Broker; Kuantic Server

IoT Devices
IoT-enabled vehicles w/sensors; IoT enabled traffic lights (presence detectors 79GHz)