How Would You Build a SMART City
Requirements

Transportation services
Public communication services
Public safety services
Tourism
Maintenance services
Commerce
Cost effective
Scalable & reliable

Data Ownership
Interoperable

SMART CITY
BUILDING TOMORROW’S CITIES

EXACTA
Global Smart Solutions
Approach #1: Start Small, then expand
Approach #1: Start Small, then expand

- New domain benefits from having a framework to build upon
- New domain may have less freedom of choice
- New domain may drive changes to the existing domain
Approach #1: Start Small, then expand

Smart Emergency Services
Smart Transportation
Smart Infrastructure

Vertical Information Flow

Data Ownership
Interoperable
Scalable & reliable
Cost effective
Approach #2: Select the best fit solution

- Smart Emergency Services
- Smart Transportation
- Smart Infrastructure

- Vertical Information Flow

- Data Ownership
- Interoperable
- Scalable & reliable
- Cost effective
Analysis of these approaches
An approach using oneM2M:
Step 1 – Start Small

- choose your data model
- implement applications
- deploy applications
- repeat for each vertical

PRO - Easy to implement; Domain expertise and devices and applications are not constrained

PRO - Less expensive than trying to force data models from different domains to be the same

CON - no sharing of data between siloes (no different than any other IoT platform)

OPPORTUNITY - collaborate on the data models when it is easy to do.
An approach using oneM2M: Step 2 – Federate CSEs

- Simple API to connect oneM2M CSEs
- Grant desired Access to remote applications
- Share Data

PRO - Siloed data is controlled by the "owner" who can choose to share or NOT with very fine granularity
PRO - Can share data to a remote CSE to keep network traffic low on Host CSE, while still controlling access
CON - data models may be different; foreign applications may not "understand". This may make discovery and use of data difficult.
How oneM2M addresses data model interoperability: Semantics

Generic interworking using semantic:

- Non oneM2M devices are described using the oneM2M base ontology + domain specific extensions.
- The Interworking Proxy Entity translates the ontology instance to resources on the CSE based on pre-defined instantiation rules.

Evolution of semantic in oneM2M:

1. **Release 0**: Resource Names (RN) can be defined by the client and inherit some meaning. E.g. "Temperature: 23°C".
2. **Release 1**: A set of labels (keywords) can be set for each resource. E.g. "temperature, humidity".
4. **Release 3**: Complete semantic descriptions can be added to a resource. E.g. "http://ontology.org/resource/temperature/".

Universal semantic interoperability SAREF/oneM2M:

1. **Vertical ontologies support** → SAREF and its extensions
2. **Semantic Support** → IoT base ontology + Data annotation
3. **Communication Framework** → IoT Data sharing

Advanced Semantic Discovery in Release 5
An approach using oneM2M:
Step 3 – Add Semantic annotations

- Add semantic context to data models
- Use Advance Semantic Discovery features

PRO - Semantic descriptions can be added to a data after deployment
PRO - oneM2M base ontology can make accessing data interoperable
An approach using oneM2M:
Step 3 – Add Semantic annotations

Smart Emergency Services
Smart Transportation
Smart Infrastructure

Service Layer

- Scalable & reliable
- Cost effective
- Interoperable
- Data Ownership
oneM2M Feature Summary by Release

Applications and devices have access to many features they need

Release 1
- Registration
- Discovery
- Security
- Group Management
- Data Mgmt. & Repository
- Subscription & Notification
- Device Management
- Communication Mgmt
- Service Charging
- Network Service Exposure
- App & Service Mgmt
- HTTP/CoAP/MQTT Bindings

Release 2
- Time Series Data
- Flexible Resources that can be customized by app developers (flex container)
- Semantics Description & Discovery
- Security Enhancements
  - Dynamic Authorization
  - Content Security
  - E2E Security
- WebSocket Binding
- Ontology for Home Area Information Model
- oneM2M App-ID Registry
- oneM2M Interworking
  - LWM2M
  - Alljoyn
  - 3GPP Triggering

Release 3
- Semantic Querying/Mashup
- 3GPP SCEF Interworking
  - Non-IP Data Delivery
  - UE reachability Monitoring
  - Device triggering
  - Etc.
- Transaction Management
- Service Layer routing
- Common oneM2M Interworking Framework
  - OCF
  - OPC-UA
  - OSGi
- oneM2M Conformance Tests and Profiles
- Security Enhancements
  - Distributed Authorization
  - etc.
- Ontology Based Interworking

Release 4
+ SDT 4.0 and the Information Models for Multiple Domains
+ oneM2M Conformance Tests
+ Geo Query
+ Process Management
+ Message Primitive Profiles
+ Semantic Reasoning
+ Time Management
+ Enhanced 3GPP Interworking
  - Session QoS
  - Congestion Monitoring
+ Fog/Edge Computing
  - Software Campaigning
  - Resource Synchronization
+ Service Subscriber Management
+ Security Enhancements
+ Group Anycast/Somecast
+ Modbus Interworking
+ Discovery Based Operations
+ Semantic Ontology Mapping
Release 5 is being developed now.

- AI enablement
- Information Model enhancements – SDT4.0
- Support of Data Protection Regulations
- Support of Data License Management
- Smart City and Enterprise domain enablement enhancement
- Advanced Semantic Discovery
- Additional Interworkings (e.g. OGC’s Sensor Thing API)
- Effective IoT Communication to Protect 3GPP Networks
Show me the GREEN

- Reduce costs by supporting siloed development
- Reduce costs by eliminating development of common features that have been done many times already
- Reduce costs by sharing data that is already available
- Reduce costs by leveraging the cumulative contributions by many engineers and researchers around the world for free
- Reduce costs by reusing existing deployed devices
- Reduce costs by participating in oneM2M to collaborate on development of new features
- Reduce costs by eliminating vendor lock-in
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