oneM2M TS-0004

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oneM2M IoT 플랫폼 기술

개요

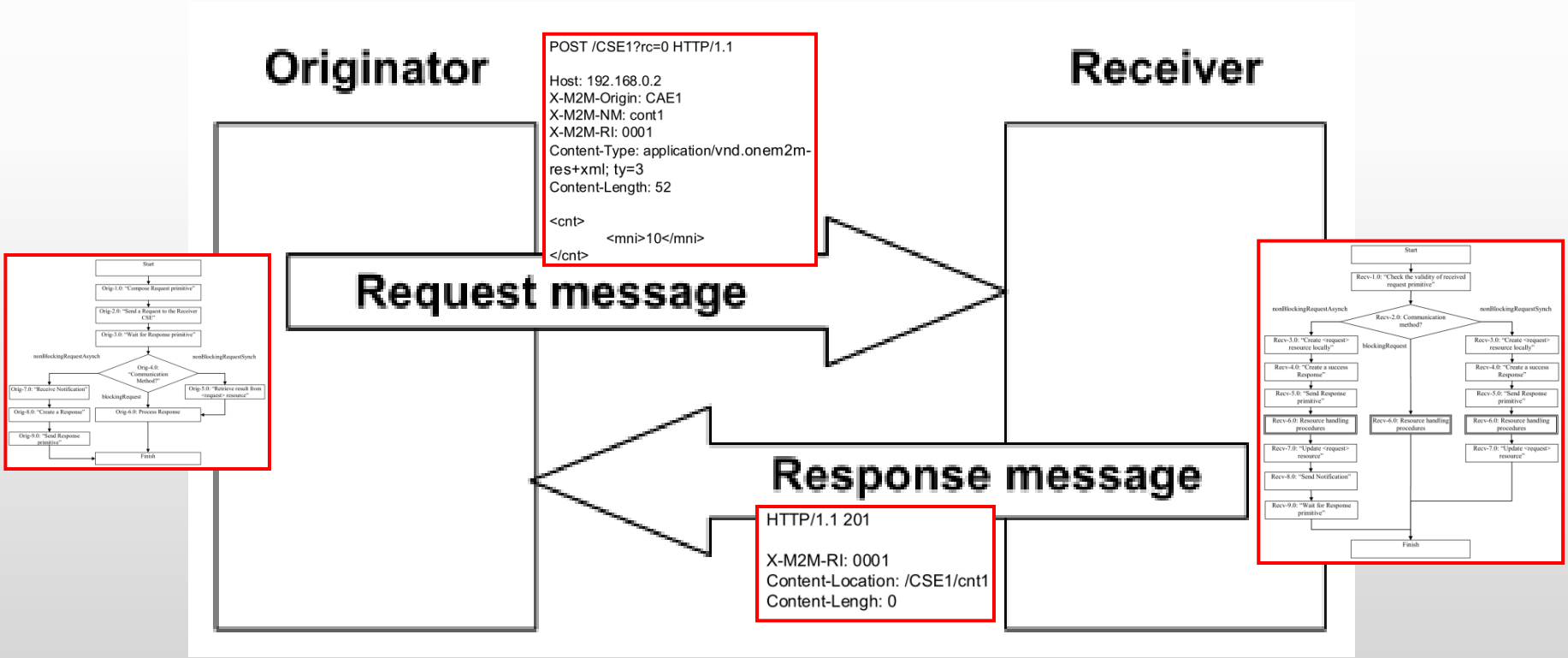
- TS-0004 는
  - TS-0001에서 정의 기능들의 구현을 위한 내용을 기술함
  - oneM2M Entity(CSE, AE)들간의 통신 프로토콜 관련 내용
    - 각 프로토콜(HTTP, CoAP, MQTT) 바인딩 내용은 별도 문서(TS-0008, TS-0009, TS-0010)에서 기술함
  - Originator와 Receiver의 입장에서 Request/Response 처리 절차

- 목차 구성

1장~4장	이 문서에 대한 개요(문서의 범위, 용어 등)을 기술하고 있음
5장	프로토콜 설계 개념을 기술하고 있음
6장	데이터 타입 정의 XML 스키마 파일과 병행하여 보면 좋음
7장	Request/Response 처리 절차
8장	Request/Response, oneM2M resource의 XML/JSON 표현 방법과 short name을 기술함

개요

- 주요 내용
  - Request/Response 메시지 포맷
  - oneM2M resource 정보 포맷
  - 데이터 타입 정의
  - Request/Response processing procedure
  - XML 스키마 (별도 파일)



5.3 Primitives

- Mca, Mcc, Mcc' 를 통해 주고 받는 메시지(Request/Response)를 의미함
- 실제로 메시지 전송하는 프로토콜(HTTP, CoAP, MQTT)에 독립적인 추상화 모델을 정의함

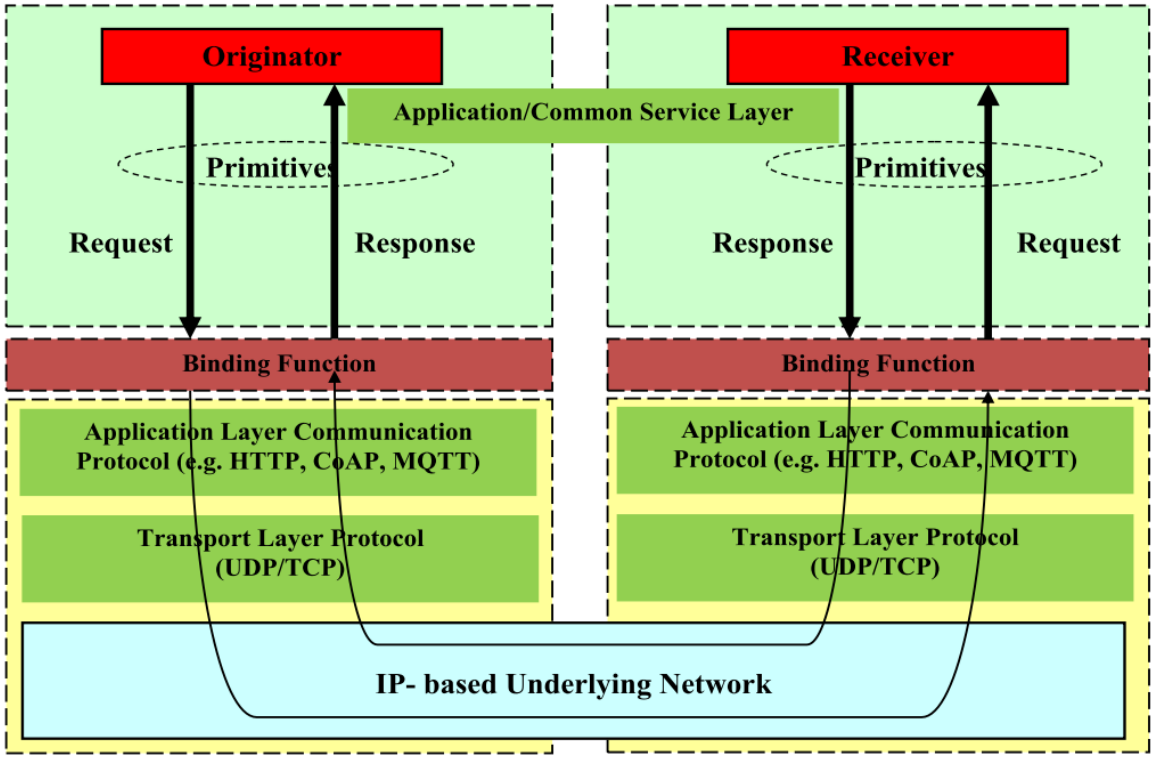


Figure 5.3.1-1: Communication model using Request and Response primitives over an IP-based Underlying Network

5.3 Primitives

- Primitives는 아래 그림과 같이 Control part와 Content part로 구성됨
  - Control part
    - Primitive 를 어떻게 처리할지에 대한 정보
    - TS-0001 clause 8.1.2와 clause 8.1.3에서 정의한 Request/Response의 파라미터
  - Content part
    - optional part로 Primitive의 Content 파라미터의 값을 의미함
    - 다음의 정보가 optional part가 됨
      - Resource Representation
      - Notification
      - Aggregated Notification
      - Resource URI
      - Resource URI 리스트

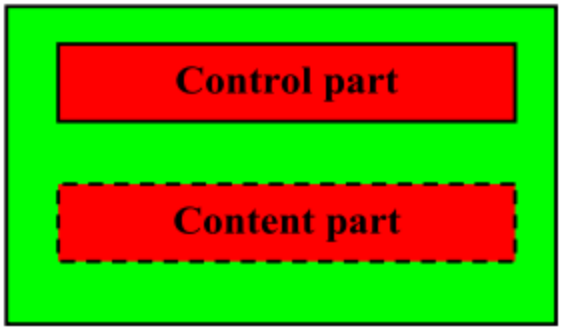


Figure 5.3.2-1: Primitives modelling

6.5 Resource data types

- 각 oneM2M resource의 데이터 포맷은 별도의 XML Schema (XSD) 파일에서 정의하고 있음

- 각 oneM2M resource는 아래 그림의 base resource type을 상속받음

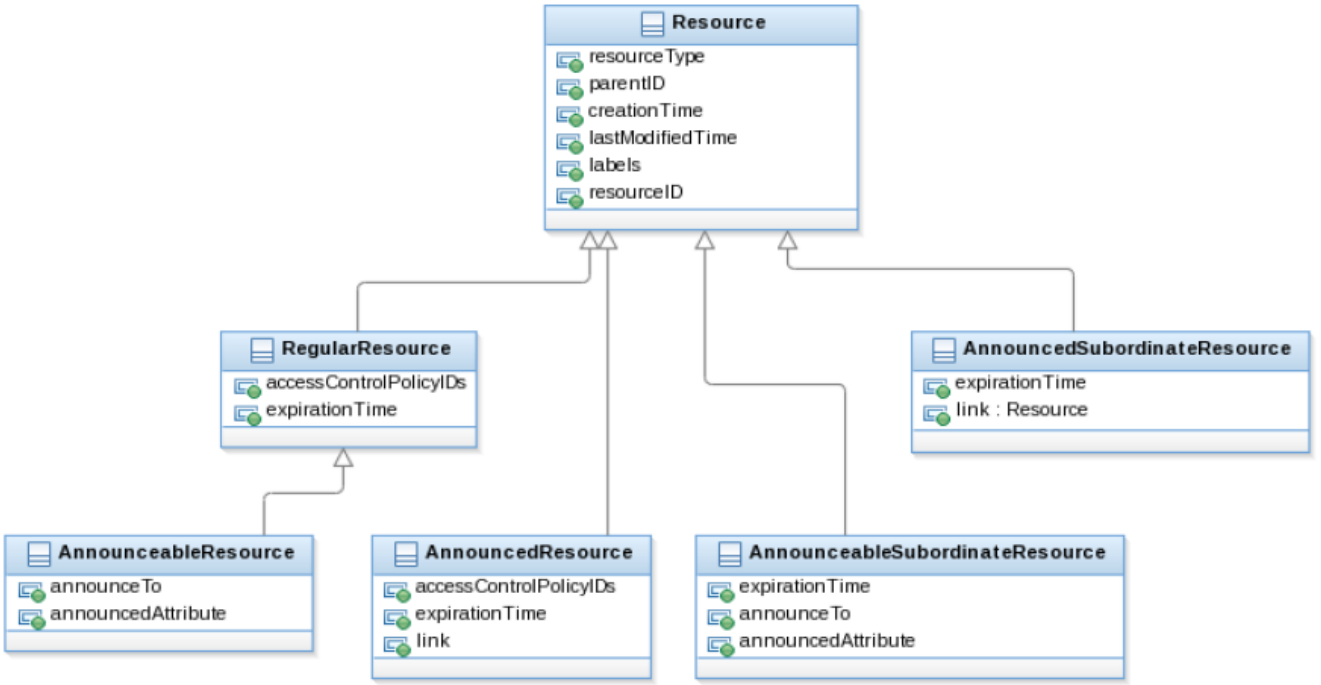
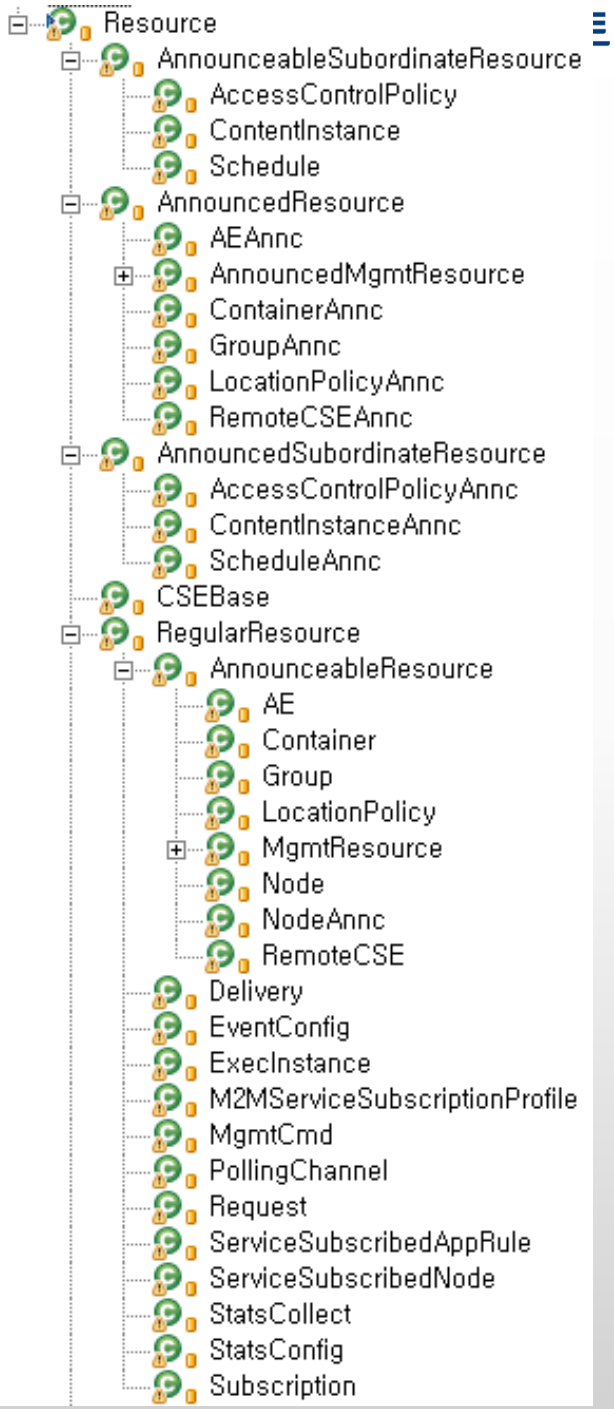


Figure 6.5.1-1: Resource Types

6.5 Resource data types

- oneM2M resource 클래스 상속 관계
  - Virtual Resource의 경우, 실체가 존재하지 않기 때문에 맵핑되는 클래스가 없음



6.6 Response status code

- Response status code class를 정의하고, 각 class 별 세부 status code를 정의하고 있음
  - 세부 status code는 TS-0004 문서 참조

Table 6.6.2-1: Definition of Response Status Code class

Status Class	Codeclass	Interpretation
Informational	1xxx	The request is successfully received, but the request is still on process.
Success	2xxx	The request is successfully received, understood, and accepted.
Redirection	3xxx	(Not used in present release)
Originator Error	4xxx	The request was malformed by the Originator and, is rejected.
Receiver Error	5xxx	The requested operation cannot be performed due to an error condition at the Receiver CSE.
Network Service Error	6xxx	The requested operation cannot be performed due to an error condition at the Network Serivce Entity.

6.7 oneM2M specific MIME media types

- oneM2M을 위한 MIME media type을 별도 정의함

Table 6.7-1: oneM2M specific MIME media types

oneM2M specific MIME subtype	mapped oneM2M data type	Note
vnd.onem2m-res+xml	m2m:resource	For oneM2M resource operation.The type of oneM2M resource in content shall be indicated by "ty" parameter. XML serialization rule is applied. (See clause 7.4.2)
vnd.onem2m-res+json	m2m:resource	Same information of above. JSON serialization rule is applied. (See clause 7.4.2)
vnd.onem2m-ntfy+xml	m2m:notification or m2m:aggregatedNotification	For Notify operation for resource subscription. XML serialization rule is applied. (See clause 7.4.1)
vnd.onem2m-ntfy+json	m2m: notification or m2m:aggregatedNotification	Same information of above. JSON serialization rule is applied. (See clause 7.4.1)
vnd.onem2m-attrs+xml	m2m:attributeList	For exchanging alist of oneM2M resource attributes and its value when it is needed. XML serialization rules is applied. (See clause 7.4.2)
vnd.onem2m-attrs+json	m2m:attributeList	Same information of above. JSON serialization rule is applied. (See clause 7.4.2)
vnd.onem2m-preq+xml	m2m:requestPrimitive	For exchanging serialized oneM2M request primitive. XML serialization rule is applied. (See clause 6.4.1 and 7.1.1.1)
vnd.onem2m-preq+json	m2m:requestPrimitive	Same information of above. JSON serialization rule is applied. (See clause 6.4.1 and 7.1.1.1)
vnd.onem2m-prsp+xml	m2m:responsePrimitive	For exchanging Response parameters. XML serialization rules is applied. (See clause 6.4.2 and 7.1.1.2)
vnd.onem2m-prsp+json	m2m:responsePrimitive	Same information of above. JSON serialization rule is applied. (See clause 6.4.2 and 7.1.1.2)

7.1 Primitive format and generic procedure

- Request primitive format

Table 7.1.1.1-1: Request Primitive Parameters

Primitive Parameter	CREATE	RETRIEVE	UPDATE	DELETE	NOTIFY
Operation	M	M	M	M	M
To	M	M	M	M	M
From	M	M	M	M	M
Request Identifier	M	M	M	M	M
Resource Type	M	NP	NP	NP	NP
Name	O	NP	NP	NP	NP
Content	M	O	M	NP	M
Originating Timestamp	O	O	O	O	O
Request Expiration Timestamp	O	O	O	O	O
Result Expiration Time	O	O	O	O	O
Operation Execution Time	O	O	O	O	O
Response Type	O	O	O	O	O
Result Persistence	O	O	O	O	NP
Result Content	O	O	O	O	NP
Event Category	O	O	O	O	O
Delivery Aggregation	O	O	O	O	O
Group Request Identifier	O	O	O	O	O
Filter Criteria	NP	O	O	O	NP
Discovery Result Type	NP	O	NP	NP	NP

M: Mandatory, O: optional, NP: not present

7.1 Primitive format and generic procedure

- Request primitive format
  - XML Schema는 CDT-requestPrimitive-v1_3_0.xsd 파일 참조

```
<xs:element name="requestPrimitive" >
  <xs:complexType>
    <xs:sequence>
      <!-- parameter "Operation"  -->
      <xs:element name="operation" type="m2m:operation" minOccurs="1"/>
      <!-- parameter "To" -->
      <xs:element name="to" type="xs:anyURI" minOccurs="1"/>
      <!-- parameter "From" -->
      <xs:element name="from" type="m2m:ID" minOccurs="1"/>
      <!-- parameter "Request Identifier" -->
      <xs:element name="requestIdentifier" type="m2m:requestID" minOccurs="1"/>
      <!-- parameter "ResourceType" -->
      <xs:element name="resourceType" type="m2m:resourceType" minOccurs="0"/>
      <!-- parameter "Name" -->
      <xs:element name="name" type="xs:NCName" minOccurs="0"/>
      <!-- parameter "Content" -->
      <xs:element name="primitiveContent" type="m2m:primitiveContent" minOccurs="0"/>
      <!-- parameter "Role" -->
      <xs:element name="role" type="xs:anyType" minOccurs="0"/>
      <!-- parameter "Originating Timestamp" -->
      <xs:element name="originatingTimestamp" type="m2m:timestamp" minOccurs="0"/>
      <!-- parameter "Request Expiration Timestamp" -->
      <xs:element name="requestExpirationTimestamp" type="m2m:absRelTimestamp" minOccurs="0"/>
      <!-- parameter "Result Expiration Timestamp" -->
      <xs:element name="resultExpirationTimestamp" type="m2m:absRelTimestamp" minOccurs="0"/>
      <!-- parameter "Operation Execution Time" -->
      <xs:element name="operationExecutionTime" type="m2m:absRelTimestamp" minOccurs="0"/>
      <!-- parameter "Response Type" -->
      <xs:element name="responseType" type="m2m:responseTypeInfo" minOccurs="0"/>
      <!-- parameter "Result Persistence" -->
      <xs:element name="resultPersistence" type="m2m:absRelTimestamp" minOccurs="0"/>
      <!-- parameter "Result Content" -->
      <xs:element name="resultContent" type="m2m:resultContent" minOccurs="0"/>
      <!-- parameter "Event Category" -->
      <xs:element name="eventCategory" type="m2m:eventCat" minOccurs="0"/>
      <!-- parameter "Delivery Aggregation" -->
      <xs:element name="deliveryAggregation" type="xs:boolean" minOccurs="0"/>
      <!-- parameter "Group Request Identifier" -->
      <xs:element name="groupRequestIdentifier" type="xs:string" minOccurs="0"/>
      <!-- parameter "Filter Criteria" -->
      <xs:element name="filterCriteria" type="m2m:filterCriteria" minOccurs="0"/>
      <!-- parameter "Discovery Result Type" -->
      <xs:element name="discoveryResultType" type="m2m:discResType" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

7.1 Primitive format and generic procedure

- Response primitive format

Table7.1.1.2-1 : Response Primitive Parameters

Primitive parameter	Ack	CREATE Success	RETRIEVE Success	UPDATE Success	DELETE Success	NOTIFY Success	Error
Response Status Code	M	M	M	M	M	M	M
Request Identifier	M	M	M	M	M	M	M
Content	O	O	M	O	O	O	O
To	O	O	O	O	O	O	O
From	O	O	O	O	O	O	O
Originating Timestamp	O	O	O	O	O	O	O
Result Expiration Timestamp	O	O	O	O	O	O	O
Event Category	O	O	O	O	O	O	O

M: Mandatory, O: optional, NP: not present

7.1 Primitive format and generic procedure

- Response primitive format
  - XML Schema는 CDT-responsePrimitive-v1_3_0.xsd 파일 참조

```
<xs:element name="responsePrimitive" >
    <xs:complexType>
      <xs:sequence>
        <!-- Response Code and Status Code primitive parameters defined in TS-0001 have been merged into
             Response Status Code  in TS-0004 -->
        <!-- parameter "Response Status Code" -->
        <xs:element name="responseStatusCode" type="m2m:responseStatusCode" minOccurs="1"/>
        <!-- parameter "Request Identifier" -->
        <xs:element name="requestIdentifier" type="m2m:requestID" minOccurs="1"/>
        <!-- parameter "Content" -->
        <xs:element name="primitiveContent" type="m2m:primitiveContent" minOccurs="0"/>
        <!-- parameter "To" -->
        <xs:element name="to" type="m2m:ID" minOccurs="0"/>
        <!-- parameter "From" -->
        <xs:element name="from" type="m2m:ID" minOccurs="0"/>
        <!-- parameter "Originating Timestamp" -->
        <xs:element name="originatingTimestamp" type="m2m:timestamp" minOccurs="0"/>
        <!-- parameter "Result Expiration Timestamp" -->
        <xs:element name="resultExpirationTimestamp" type="m2m:absRelTimestamp" minOccurs="0"/>
        <!-- parameter "Event Category" -->
        <xs:element name="eventCategory" type="m2m:eventCat" minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
```

7.1 Primitive format and generic procedure

- Generic resource request procedure for originator

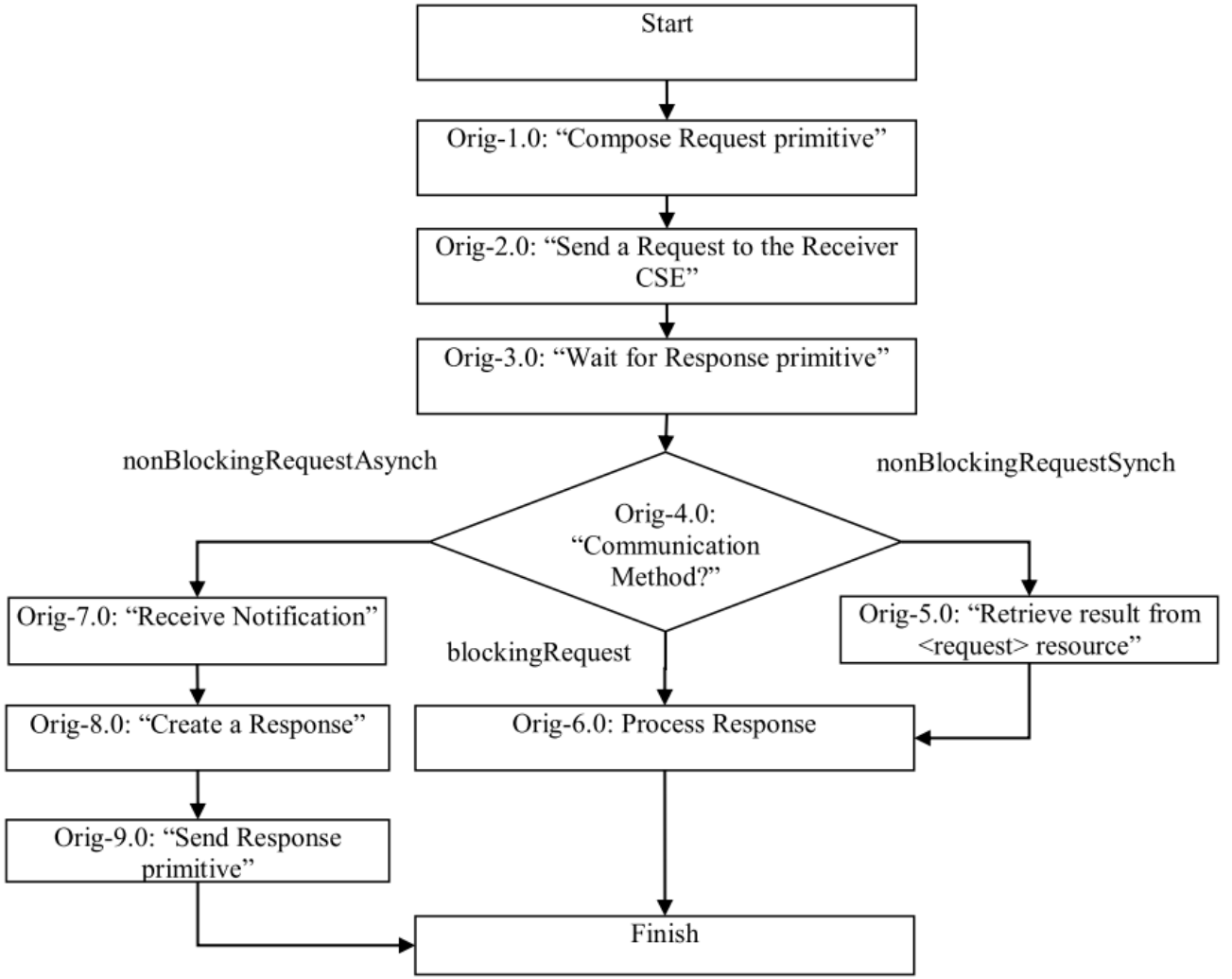


Figure 7.1.2.1-1: Generic procedure of Originator

7.1 Primitive format and generic procedure

- Generic request procedure for receiver (전체)

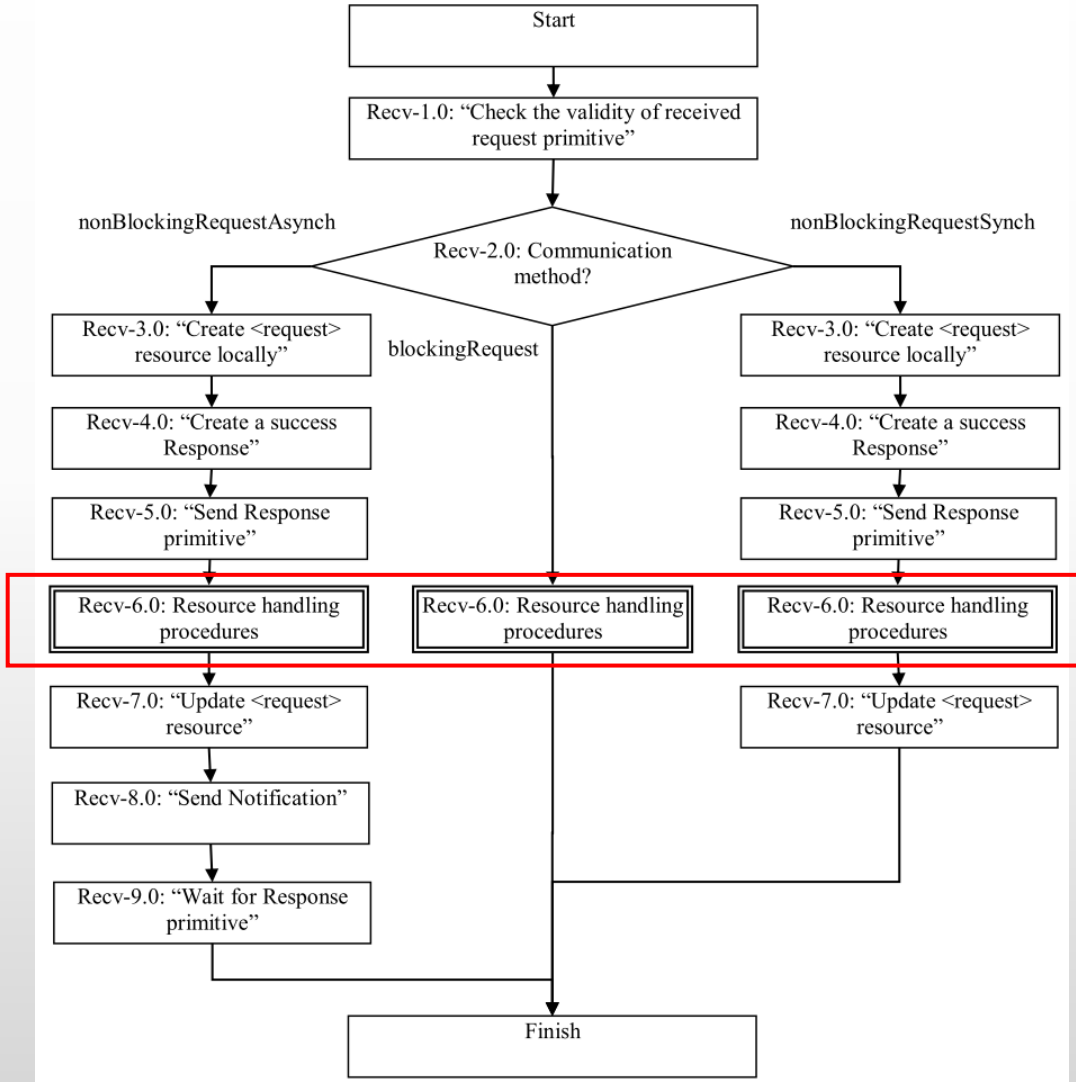


Figure 7.1.2.2-1: Generic procedure of Receiver

Recv-6.0은
다음 슬라이드에서
별도 설명

7.1 Primitive format and generic procedure

- Resource handling procedure for receiver
  - receiver가 Hosting CSE인지 아닌지에 따라 처리 흐름이 달라짐

receiver가 Hosting CSE가 아닌 경우

receiver가 Hosting CSE인 경우

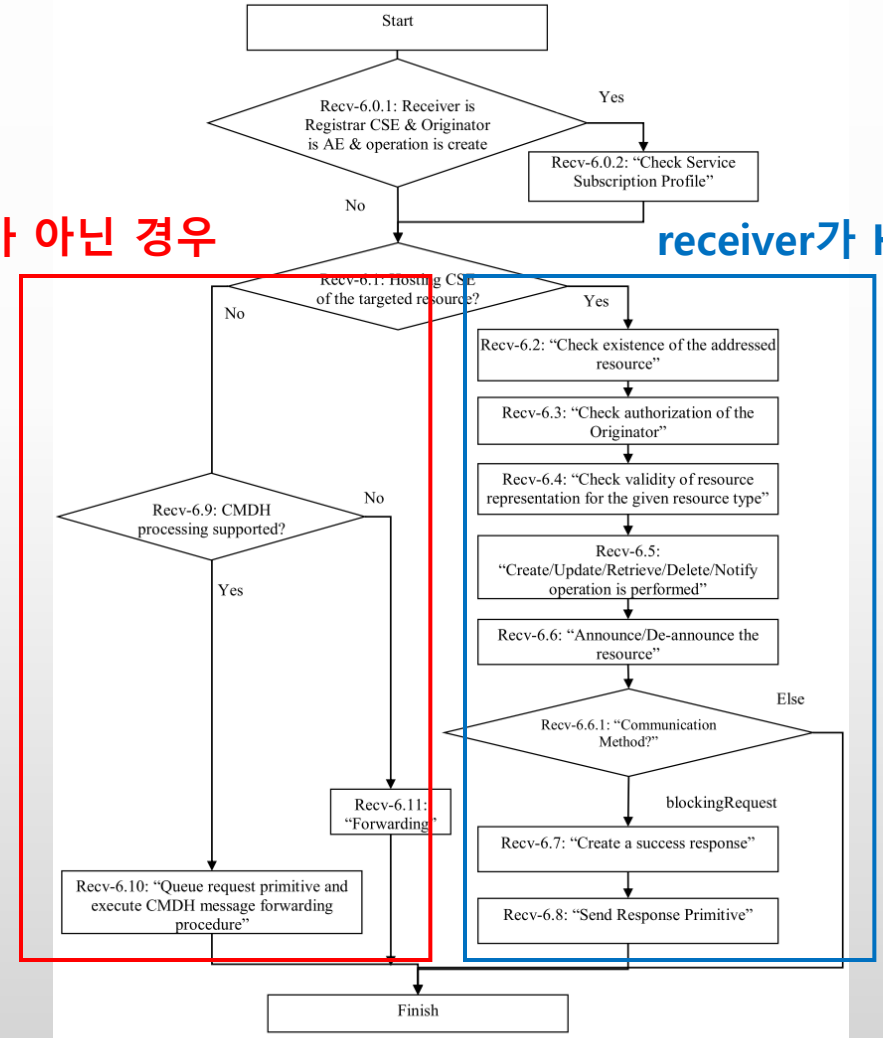


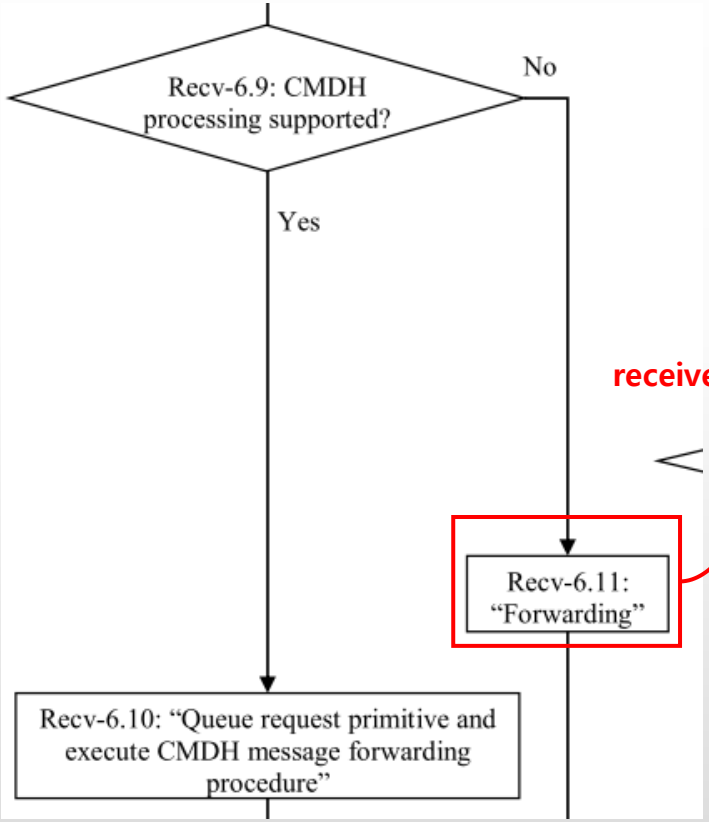
Figure 6.3.3.2.30-2: Resource handling procedure

7.1 Primitive format and generic procedure

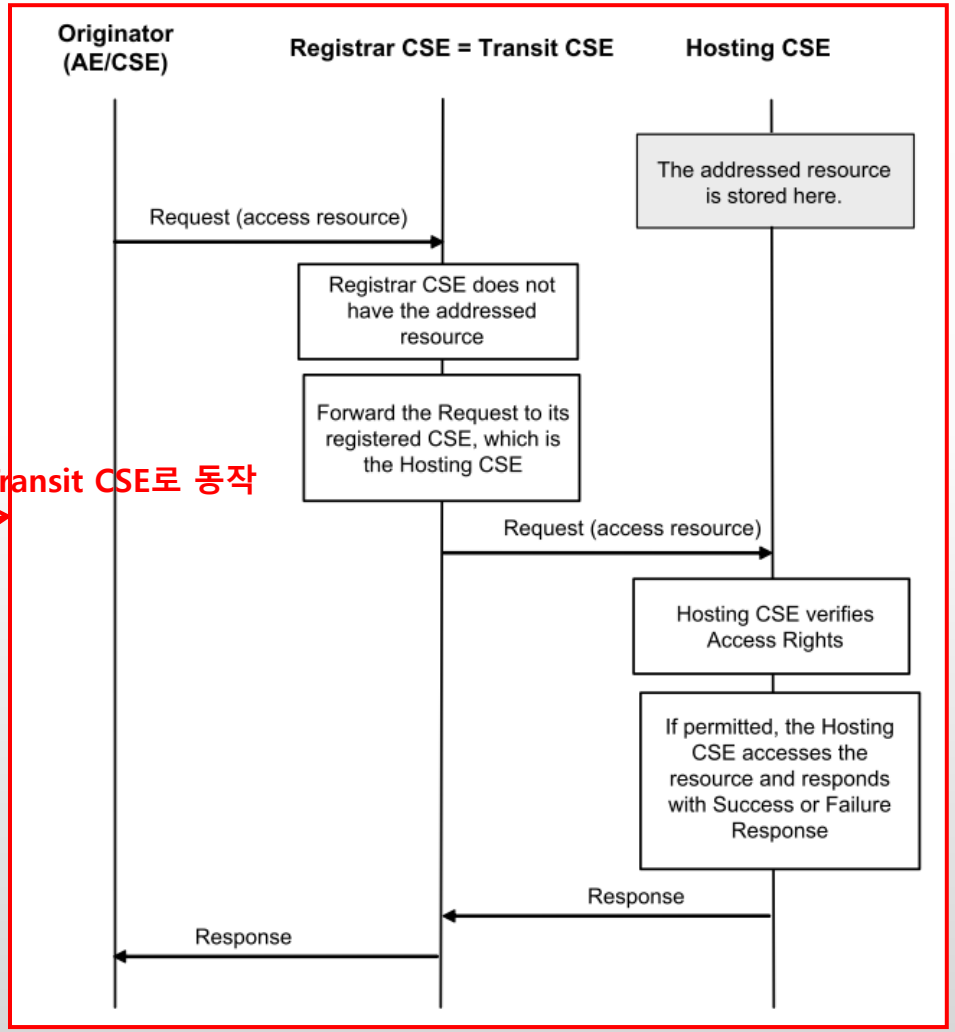
- Resource handling procedure for receiver
  - receiver가 Hosting CSE인지 아닌지 판단 조건
    - Request의 To 파라미터(resource URI)가 <CSEBase> URI로 시작을 하면, receiver가 Hosting CSE임
    - 그렇지 않으면, receiver는 Hosting CSE가 아님

7.1 Primitive format and generic procedure

- Resource handling procedure for receiver
  - receiver가 Hosting CSE가 아닌 경우

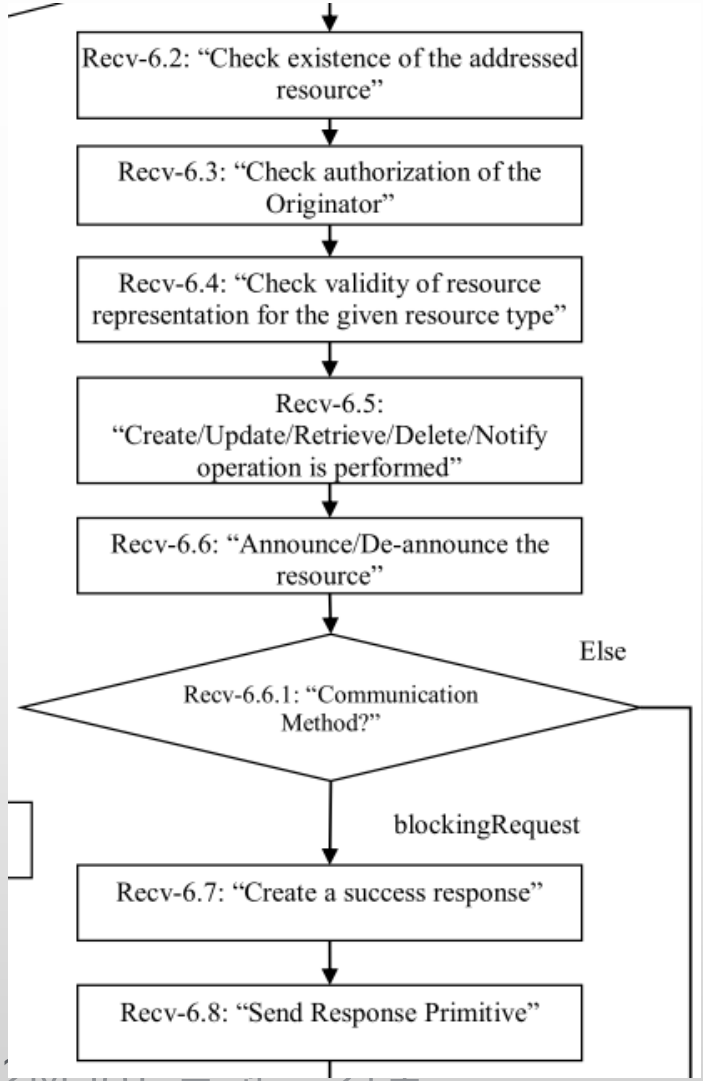


receiver가 Transit CSE로 동작



7.1 Primitive format and generic procedure

- Resource handling procedure for receiver
  - receiver가 Hosting CSE인 경우



Recv-6.2: To 파라미터의 resource가 존재하는지 확인
존재하지 않으면 NOT_FOUND로 응답

Recv-6.3: Originator의 접근 권한 확인
권한이 없으면 ACCESS_DENIED로 응답

Recv-6.4: resource representation 유효성 확인
유효하지 않으면 BAD_REQUEST로 응답

Recv-6.5: 각 operation별 처리

Recv-6.6: Announce/De-announce 관련 설정이 되어 있다면,
그에 따른 처리

7.2 Common operations

- TS-0004 clause 7.1에서 기술한 procedure에서 각 step에 대한 설명을 기술하고 있음
  - clause 7.2.1 에서는 originator procedure의 각 step에 대해 설명
  - clause 7.2.2와 7.2.3 에서는 receiver procedure의 각 step에 대해 설명

7.3 Resource type-specific procedures and definitions

- 각 oneM2M resource 타입 별로 다음의 내용을 기술하고 있음
  - resource 요약 설명
  - XML Schema 파일 이름
  - Create/Update operation request의 resource 속성의 M, O, NP 여부
  - child resource 목록
  - 각 operation 별로의 Originator와 Receiver의 procedure

7.3 Resource type-specific procedures and definitions

- <CSEBase> resource

Table 7.3.3.1-1: Data type definition of <CSEBase> resource

Data Type ID	File Name	Note
CSEBase	*CDT-CSEBase-v1_0_0.xsd*	

Table 7.3.3.1-2: Universal/Common Attributes of <CSEBase> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	NP	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicy IDs	NP	NP
creationTime	NP	NP
lastModifiedTime	NP	NP
Labels	NP	NP

Table 7.3.3.1-3: Resource Specific Attributes of <CSEBase> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
cseType	NP	NP	m2m:cseTypeID	No default
CSE-ID	NP	NP	m2m:ID	No default
supportedResource Type	NP	NP	list of m2m:resourceType	No default
pointOfAccess	NP	NP	m2m:pOAList	No default
nodeLink	NP	NP	xs:anyURI	No default

7.3 Resource type-specific procedures and definitions

- <CSEBase> resource

Table 7.3.3.1-4: Child resources of <CSEBase> resource

Child Resource Type	Child Resource Name	Multiplicity	Ref. to Resource Type Definition
<remoteCSE>	[variable]	0..n	Clause 7.3.4
<node>	[variable]	0..n	Clause 7.3.18
<AE>	[variable]	0..n	Clause 7.3.5
<container>	[variable]	0..n	Clause 7.3.6
<group>	[variable]	0..n	Clause 7.3.13
<accessControlPolicy>	[variable]	0..n	Clause 7.3.2
<subscription>	[variable]	0..n	Clause 7.3.8
<mgmtCmd>	[variable]	0..n	Clause 7.3.16
<locationPolicy>	[variable]	0..n	Clause 7.3.10
<statsConfig>	[variable]	0..n	Clause 7.3.23
<statsCollect>	[variable]	0..n	Clause 7.3.25
<request>	[variable]	0..n	Clause 7.3.12
<delivery>	[variable]	0..n	Clause 7.3.11
<schedule>	[variable]	0..1	Clause 7.3.9
<m2mServiceSubscriptionPolicy	[variable]	0..n	Clause 7.3.19
<serviceSubscribedAppRule>	[variable]	0..n	Clause 7.3.29

7.3 Resource type-specific procedures and definitions

- 나머지 resource는 TS-0004 참조