

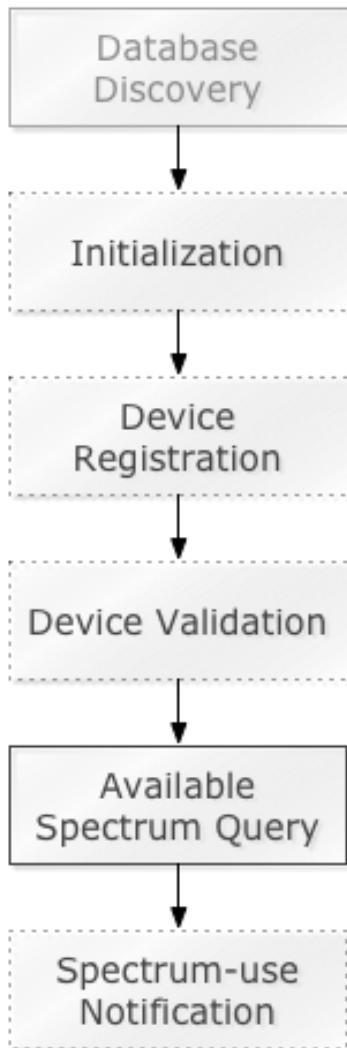
Outline

- Status of the PAWS protocol document
- Open Issues
 - Review extensibility and IANA registries

Changes from version 00

- Added JSON encoding
 - GeoLocation uses RFC5491
- Added Extensibility section
 - Described how to address new jurisdictions
 - References IANA registries
- Added IANA section
 - Defined registry tables

Protocol Overview



- Database Discovery (TBD)
- Initialization
 - Initial handshake: Exchange capability info
 - Optional for device, DB must support
- Device Registration
 - Regulator-specific (e.g., not all regulators)
- Device Validation
 - Validation of slave devices by master devices asking database
 - Regulator-specific
- Available Spectrum Query
- Spectrum-use Notification
 - Regulator-specific

Encoding: JSON-RPC

- Examples
- GeoLocation
- Extensibility / IANA definitions

Encoding Example: Request

getSpectrum Request:

```
{
  "method": "getSpectrum",
  "params": {
    "type": "AVAILABLE_SPECTRUM_REQ",
    "version": "1.0",
    "deviceDesc": {
      "serialNumber": "XXX",
      "fccId": "YYY",
      ...
    },
    "location": {
      "point": {
        "center": {"latitude": 37.0, "longitude": -101.3}
      }
    },
    "antenna": {"height": 10.2, "heightType": "AGL"}
  },
  "id": "xxxxxx",
}
```

Encoding Example: Response

Available Spectrum Response

```
{
  "result": {
    "type": "AVAILABLE_SPECTRUM_RESP",
    "version": "1.0",
    "timestamp": "2013-03-02T14:30:21Z",
    "deviceDesc": {
      "serialNumber": "XXX",
      "fccId": "YYY",
      ...
    },
    "spectrumSchedules": [
      {
        "eventTime": {
          "startTime": "2013-03-02T14:30:21Z",
          "stopTime": "2013-03-02T20:00:00Z",
        },
        "spectra": [
          {
            "bandwidth": 6e6,
            "frequencyRanges": [
              {"startHz": 5.18e8, "stopHz": 5.36e8,
               "maxPowerDBm": 30.0},
              {"startHz": 5.36e8, "stopHz": 5.42e8,
               "maxPowerDBm": 36.0},
              ...
            ]
          },
          ...
        ]
      },
      ...
    ]
  },
  "eventTime": {
    "startTime": "2013-03-02T22:00:00Z",
    "stopTime": "2013-03-03T14:30:21Z",
  },
  "spectra": [
    ...
  ]
},
"needsSpectrumReport": false
},
"id": "xxxxxxx"
}
```

Encoding: GeoLocation

- Location encoding follows RFC5491
 - Point-with-uncertainty encoded using Ellipse
 - Region encoded using Polygon
 - WGS-84 default datum

Example GeoLocation

```
"location": {  
  "point": {  
    "center": {"latitude": 37.1, "longitude": -120.2},  
    "orientation": 45.0,  
    "semiMajorAxis": 50.0,  
    "semiMinorAxis": 45.0  
  }  
}
```

```
"location": {  
  "region": {  
    "exterior": [  
      {"latitude": 37.1, "longitude": -120.2},  
      {"latitude": 37.1, "longitude": -120.1},  
      {"latitude": 37.0, "longitude": -120.1},  
      ...  
    ]  
  }  
}
```

Extensibility

- Defines processes for creating:
 - New message parameters
 - Additional error codes
 - Ruleset identifiers
- Proposes new IANA registries
 - PAWS Parameters Registry
 - PAWS Error Code Registry
 - PAWS Ruleset ID Registry
 - Additions made under Designated Expert process with “Specification Required” [RFC5226]

Ruleset Identifier

- Represents a set of rules to be used within a regulatory domain
 - A “harmonized” ruleset may be adopted by multiple domains
- Associated with:
 - Database behavior
 - Device behavior
 - Parameters passed between Device and Database

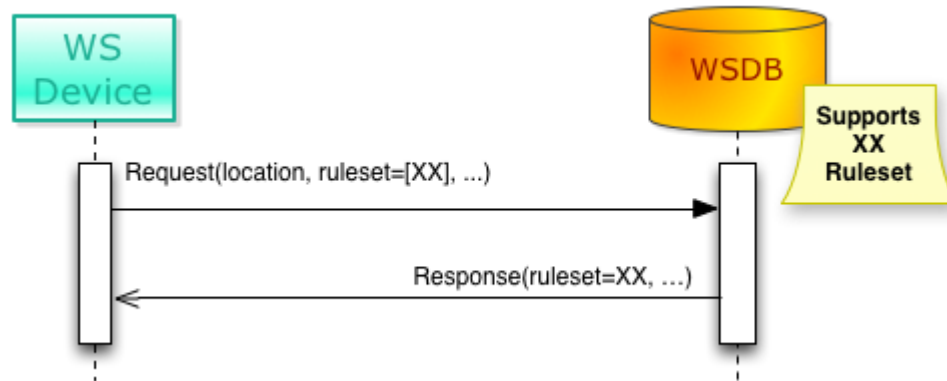
General Procedure Handles Extensibility

- Device makes a request that includes its location and may include:
 - List of rulesets it supports
 - Parameter values for the request
- If necessary, Database responds with REQUIRED error and list of missing parameters
- Device makes request again that includes its location and:
 - List of rulesets it supports
 - Parameter values that now include the required ones
- Database sends the response, including applicable ruleset for the location

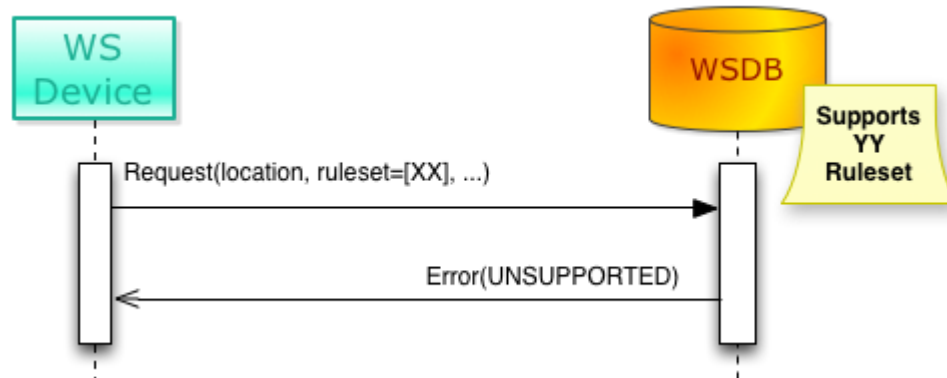
Ruleset Identifier Use Cases

- Simple Cases: Single rulesets

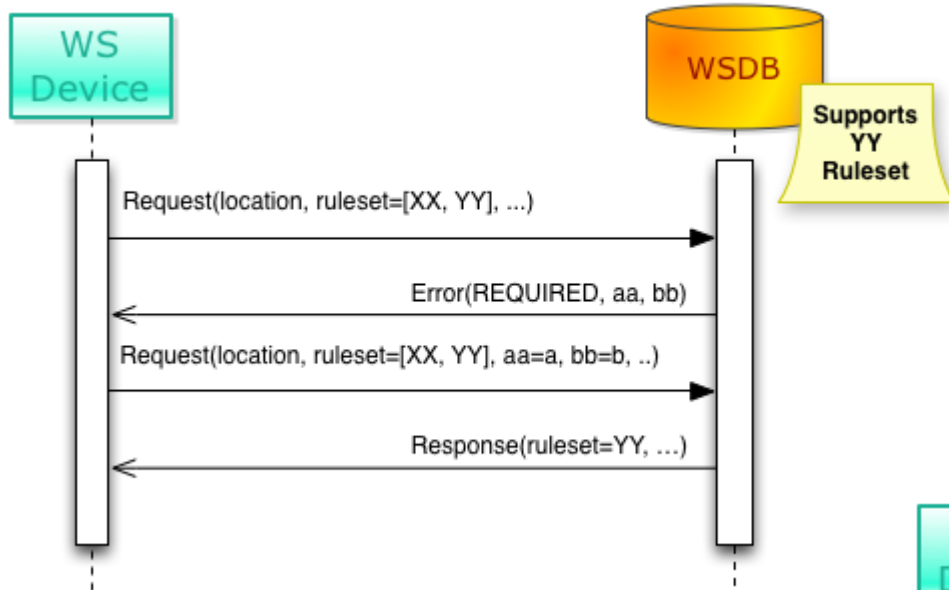
- Correct DB



- Wrong DB

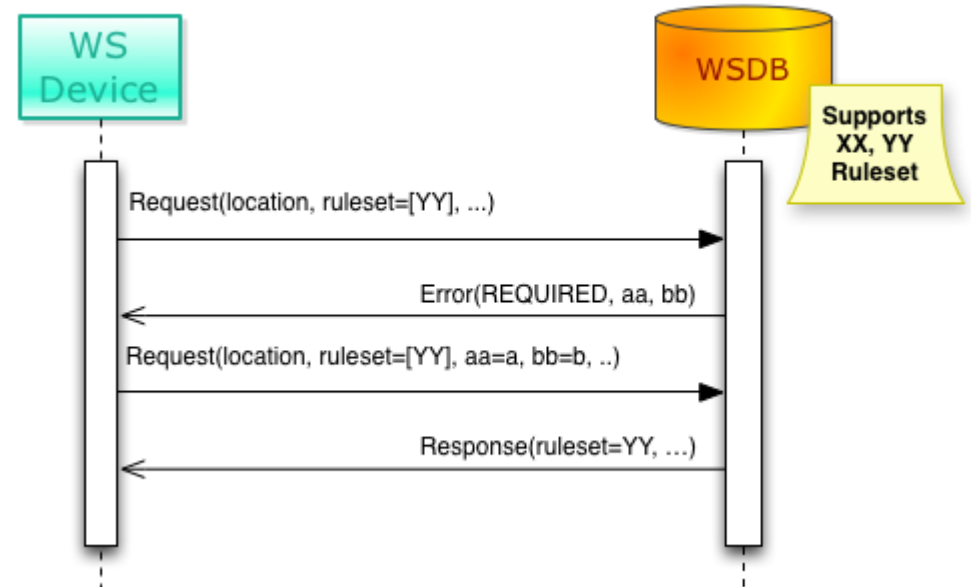


Ruleset Identifier Use Cases



Device supports multiple rulesets

Database supports multiple rulesets
(may avoid discovery)



Nokia Internal Use Only

IANA: PAWS Parameters Registry

- Defines new parameters
 - E.g., to support regulatory-specific parameters
- Must include:
 - Parameter name
 - Parameter usage location, e.g., which message(s)
 - Specification document
- Initial contents:
 - “fccId”: FCC certification ID
 - “fccTvbdDeviceType”: “FIXED”, “MODE_1”, or “MODE_2”
 - Add other regulatory parameters as rules are finalized

IANA: PAWS Error Code Registry

- Defines error codes
- Specify:
 - Code
 - Name
 - Additional parameters, if any
 - Parameters separately defined in Parameters Registry
 - Description
- Initial contents:
 - Defined in the Section 5.13 of protocol doc

Error Codes

Code	Name	Description
-----	-----	-----
-100	(reserved)	
-101	VERSION	The Database does not support the specified version of the message.
-102	UNSUPPORTED	The Database does not support the Device. For example, it does not support the regulatory domain specified in the request.
-103	UNIMPLEMENTED	The Database does not implement the optional request or optional feature.
-104	OUTSIDE_COVERAGE	The specified geo-location is outside the coverage area of the Database.
-200	(reserved)	
-201	REQUIRED	A required parameter is missing. The Database MUST include a list of the required parameter names. The Database MAY include only names of parameters that are missing, but MAY include a full list. Including the full list of missing parameters may reduce the number of re-queries from the Device.
-202	INVALID_VALUE	A parameter value is invalid in some way. The Database SHOULD include a message indicating which parameter(s) and why the value is invalid.
-300	(reserved)	
-301	UNAUTHORIZED	The Device is not authorized to use the Database. Authorization may be determined by regulatory rules or be dependent on prior arrangement between the Device and Database.
-302	NOT_REGISTERED	Device registration required, but the Device is not registered.

IANA: PAWS Ruleset ID Registry

- Defines ruleset identifiers
- Specify:
 - Name
 - Additional message parameters, if any
 - Parameters separately defined in Parameters Registry
 - Specification Document
- Initial contents
 - “FccTvBandWhiteSpace-2010”
 - Add other regulatory parameters as rules are finalized

Proposed IANA Process

- Review by Designated Experts
 - “Specification Required”
 - Requests sent to: paws-ext-review@ietf.org
 - Two-week review period on the list
 - May approve before specification formally published, but must be assured that it will be published

Implementations

- Reports of successful implementation using schema defined in current document
 - After fixing typos