**UGovOps SYBL Language**

The ***initial*** BNF description of SYBL language is shown below:

**Constraint** := constraintName : **CONSTRAINT** ComplexCondition

**Monitoring** := monitoringName : **MONITORING** varName=MetricFormula

**Strategy** := strategyName : **STRATEGY CASE** ComplexCondition : action(parameterList)| strategyName : **STRATEGY WAIT** **ComplexCondition**|

strategyName : **STRATEGY** **STOP** ComplexCondition|

strategyName : **STRATEGY RESUME** ComplexCondition

**MetricFormula** := metric | number | metricFormula **MathOperator** metric | metricFormula **MathOperator** number

**ComplexCondition** := **Condition** | **ComplexCondition BitwiseOperator Condition|(ComplexCondition BitwiseOperator Condition)**

**Condition** := metric **RelationOperator** number| number **RelationOperator** metric | **Violated**(name)|**Fulfilled**(name)

MathOperator := + | - | \* | /

BitwiseOperator := **OR** | **AND** | **XOR** | **NOT**

RelationOperator := <|>|>=|<=|==|!=

We introduced governance directive for specifying the governance scope, with all the necessary details for governing the IoT cloud (e.g., governance query, or governance operations uncertainty details).

GovernanceID: **GOVERNANCE\_SCOPE** **query** := govQuery

**CONSIDERING\_UNCERTAINTY**: govOpsUncertaintyDetails

StrategyID: **STRATEGY CASE Condition: Capability** **FOR** GovernanceID **CONSIDERING\_UNCERTAINTY:** uncertainty\_parameter1 **AND** uncertainty\_parameter2 **AND** … uncertainty\_parametern

ConstraintID: **CONSTRAINT Condition WHEN Condition CONSIDERING\_UNCERTAINTY:** uncertaintyCondition.

The BNF form for ***GovOps SYBL*** is shown below:

**Constraint** := constraintName : **CONSTRAINT** ComplexCondition|**CONSTRAINT** ComplexCondition UncertaintyDetails

**Monitoring** := monitoringName : **MONITORING** varName=MetricFormula

**Strategy** := strategyName : **STRATEGY CASE** ComplexCondition : action(parameterList)| **STRATEGY CASE** ComplexCondition : action(parameterList) **FOR** GovName UncertaintyDetails| strategyName : **STRATEGY WAIT** **ComplexCondition**|

strategyName : **STRATEGY** **STOP** ComplexCondition|

strategyName : **STRATEGY RESUME** ComplexCondition

**GovernanceScope**:= govName: **GOVERNANCE\_SCOPE Query UncertaintyDetails**

**MetricFormula** := metric | number | metricFormula **MathOperator** metric | metricFormula **MathOperator** number

**ComplexCondition** := **Condition** | **ComplexCondition BitwiseOperator**

**Condition|(ComplexCondition BitwiseOperator Condition)**

**Condition** := metric **RelationOperator** number| number **RelationOperator** metric | **Violated**(name)|**Fulfilled**(name)

**UncertaintyDetails:= CONSIDERING\_UNCERTAINTY** UncertaintyParameter

**UncertaintyParameter**:= String| String BitwiseOperator UncertaintyParameter

**Query := query:=** QueryParameter

QueryParameter= paramType=paramValue|paramType=paramValue AND QueryParameter

MathOperator := + | - | \* | /

BitwiseOperator := **OR** | **AND** | **XOR** | **NOT**

RelationOperator := <|>|>=|<=|==|!=

**Examples**

G1:**GOVERNANCE\_SCOPE**

query:= location=buildingX AND type=JACE-545

**CONSIDERING\_UNCERTAINTY**:

missing\_data = "location<='?',type<='\*'" AND

selection\_strategy = optimistic AND

use\_cache = false

S1:**STRATEGY** **CASE Fulfilled**(CND1):

setUpdateRate(5s) **FOR** G1

**CONSIDERING\_UNCERTAINTY**:

run\_in\_isolation = true **AND**

keep\_alive = 5min **AND**

degree\_parallelism = 200 **AND**

tolerate\_fault\_percentage = 20% **AND**

fallback\_count = 2 **AND**

time\_to\_next\_fallback = 500ms

C1:**CONSTRAINT** responseTime<150ms **WHEN** nrOfUsers<900

**CONSIDERING\_UNCERTAINTY**:decision\_confidence >=20%

S2:**STRATEGY CASE** Violated(C1):scaleOut()

S3:**STRATEGY CASE** Fulfilled(C1):maximize(throughput)

**CONSIDERING\_UNCERTAINTY**: considering\_strategies = S2