AMES (V4.0) Scenario File Specification

Sean L. Mooney, Dheepak Krishnamurthy

April 11, 2017

1   Definitions

Terms used in this document.

Comments follow the in-line comment style of the 'c' family of programming languages. Specifically, a comment starts with a // and continues until the end of the line. Every character after a comment marker until the end of the line is ignored.

A **POS_INT** is a digit, 1-9, followed by any digits, 0-9. A **POS_INT** is formally described by the regular expression [1-9][0-9]*

A **PROB_VAL** is a decimal representation of a probability value. Valid range is 0.0 to 1.0.

TEXT is a string of characters, including spaces and tabs, starting with any 'visible' character and terminated by the end of the line. The colon (:) is not allowed, because it is a meaningful character in the data file formats. Either Unix style \n or Microsoft Windows style \r\n are valid end of line markers, but should not be mixed in a file.

All indices begin at 1. A **day** is represented by hours 1 to 24. The first day is 1. The last day is **MaxDay**. (e.g. if **MaxDay** = 50, there must be data for day 50 and there should not be data for day 51).

2   File Specifications

A Load Case is composed of multiple files.
The Load Scenario Control describes the common parameters for the entire set of load scenarios. A Load Scenario file describes a single load scenario, where a load scenario is a set of load profiles. An Expected Load file follows almost the same format as the Load Scenario but must be marked as 'ExpectedLoad' for the scenario number.

2.1   Load Scenario Control File Description

A Load Scenario Control is the control file for the entire set of scenarios. The parameters specified by the Load Scenario Control must be matched by each Load Scenario. A Load Scenario Control file contains the following elements:

Keyword	Description
CaseName	Name of the case, used by each scenario file.
NumZones	Number of zones. Must be a **POS_INT**.
NumLoadScenarios	Number of scenarios. Must be a **POS_INT**.
	There must one load scenario for each integer in the range [1-NumLoadScenarios] (inclusive).
MaxDay	Maximum number of days. Must be **POS_INT**.
Scenario n Prob	Probability of choosing scenario n
	n must be a **POS_INT**.
Scenario n File	Path to the file representing load scenario number n
	n must be a **POS_INT**.
	All Paths are considered relative to the location of the control file.
ExpectedLoad	Name of the file representing the expected load.
	This line is optional.

Each item in the control file is a keyword describing the section of the control being specified, followed by a colon (:) followed by the value of the section.

There must be both a scenario probability and a file name for each scenario number from 1 to NumLoadScenarios. Scenarios may be assigned probabilities in one of two ways. Either a scenario is assigned a single probability or each day of each scenario is assigned a probability.

Probability assignments: $\mathrm{Prob}(\mathrm{L}_{n,d}) \geq 0, n = 1, \ldots, \mathrm{NumLoadScenarios}, \mathrm{d} = 1 \ldots \mathrm{MaxDay}$, where $\mathrm{Prob}(\mathrm{L}_{n,d})$ is the probability of occurrence for day d load profile in load scenario, L_n. These probability assignments satisfy:

$$\forall d, \mathrm{Prob}(\mathrm{L}_{1,d}) + \ldots + \mathrm{Prob}(\mathrm{L}_{\mathrm{NumLoadScenarios},d}) = 1, \text{where } 1 <= d <= \mathrm{MaxDay}. \qquad (1)$$

An example of a control file is:

```
CaseName : Example Load Case
NumZones : 8
NumLoadScenarios : 3
MaxDay : 50
Scenario 1 Prob : .2
Scenario 2 Prob : .3
Scenario 3 Prob : .5
Scenario 1 File : Scenario1.dat
Scenario 2 File : Scenario2.dat
Scenario 3 File : Scenario3.dat
ExpectedLoad    : ExpectedLoad.dat
```

If the **ExpectedLoad** file is not specified, AMES-TS will compute a default 'true expected load' for each hour of each day for each zone. This true expected load will be a probability-weighted average of the corresponding loads in the load scenario files, L_n, $n = 1, \ldots, \mathrm{NumLoadScenarios}$, where the probability, $\mathrm{Prob}(\mathrm{L}_{n,d})$ for each n is the user-specified probability for the day. Similarly, if the **ActualLoad** is not specified, one of the LoadScenarios will be chosen or constructed pseudo-randomly as the 'simulated true load'.

If a single probability is specified for an entire scenario n, instead of one for each day of the scenario, then that single probabability value will be used for each day d of scenario n.

2.2 Scenario File Description

A LoadCase has a flexible file format, split into multiple files. There are two types of files in a LoadCase – control files and data files. Control files specify what data is contained in what files and data files contain the load data.

Files containing load values also have two forms. Either single load file describes one particular set of load values for each zone for each hour of every day in the scenario file, or a load file describes a set of load values for a each hour at each zone for a single day. AMES (V4.0) represents time as sequentially numbered days with sequentially numbered hours. Hours range from 1 to 24. Days range from 1 to **MaxDay**. For example, if the control file specifies the **MaxDay**=5, and **NumZones**=8, then there *must* be $24 * 5 * 8 = 960$ separate load value entries. Either a single file must contain all of the entries or five different files can each contain a single day's worth of entries.

General specification requirements for the load scenarios pertaining to a given load case LC

- Each load value must be in MW units

- Each load value is a decimal number. The decimal point and any digits after the decimal point are not required for integral load values. Load values are subject to the precision of the internal representation, which is a double-precision floating point type.

- Each load scenario, L_n, must be identified by an extension ".dat"

- Each simulated day must consist of 24 hours H

2.2.1 Control Files

Control files contain the 'meta-data' for the LoadCase. For example, the CaseName, number of zones, number of scenarios and the paths to rest of the data files for the load case. Control files may come in two flavors – a master file and multiple auxiliary files. The auxiliary files contain paths to data files, or paths to other auxiliary files. This arrangement allows for large LoadCases to be split-up over many sub-directories and each directory managed by it's own auxiliary control file.

Control File BNF The formal BNF[1] (Backus-Naur Form) style grammar for the control files is givin in Figure 1. Typographic conventions:

- Nonterminals are enclused in <>.

- a* indicates an arbitrary number of term 'a' may be used.

- **Keyword**s are in a bold font.

- Literals are in a monospace font.

- Option? indicates the term is optional.

- [a | b] indicates choice. The term can be produced with either 'a' or 'b'.

---

[1]`http://www.antlr.org/wiki/display/ANTLR3/Quick+Starter+on+Parser+Grammars+-+No+Past+Experience+`
`Required`

<control-file> ::= <master-file> | <aux-file>
<master-file> ::= <master-header> <control-decl>*
<aux-file> ::= <aux-header> <control-decl>*
<master-header> ::= **CaseName** : <string>
                    NumZones : **POS_INT**
                    NumLoadScenarios : **POS_INT**
                    MaxDay : **POS_INT**
<aux-header> ::= **CaseName** : <string>
<control-decl> ::= <type-prefix> (**day POS_INT**)? : [path | **POS_INT** | **PROB_VAL**]
<type-prefix> ::= **Aux_Control_File**
                  | **Scenario POS_INT** <scen-data-type>
                  | **ExpectedLoad** | **ActualLoad**
<scen-data-type> ::= **File** | **Prob** | **Wind**

Figure 1: Control file description

2.2.2   Data Files

Each data file must declare what it is on the first of the line. Even though this information is given in a control file, the requirement enforces consistency between the control and data files.

A single load scenario file contains:

1. [**AllOf** | **PartOf**] : **TEXT**, [**Scenario POS_INT** | **ExpectedLoad** | **ActualLoad** | **Wind**]

2. (**Day** : **POS_INT**)?

3. The next row of entries specify the type of data for each column

    (a) First column: Day (ranging from 1 to **MaxDay**). Omitted if the day is declared in the header.

    (b) Second column: Hour (ranging from 1 to 24)

    (c) Remaining columns: Zones names are a single word, and must match the zone names from the TestCase description. The order of individual zones is arbitrary, but the columns in rest of the file must be consistent with the label. In other words if zone CE is listed as the first zone name, then the first column of loads must always represent the load for zone CE at hour h.

4. For the remaining rows, the optional day D, hour H, and zones 1 through **NumZones** are filled in, as illustrated in the sample load scenario file (§3).

The line specifing if this file is **AllOf** or **PartOf** a set of loads must be the first line in the data file. The value of the CaseName declaration must match the CaseName in the control file and the scenario number must match the scenario number in the control file. This line provides a

clear mechanism to associate the control file with the individual load scenario files and help prevent mistakes from typos.

For example, if the control file contains

```
CaseName : Case1
...
Scenario 1 File : sf1.dat
```

Then the file, sf1.dat, must start with

```
AllOf : Case1, Scenario 1
```

Alternatively, if the control file contains

```
CaseName : Case1
...
Scenario 1 Day 1 File : sfd1.dat
Scenario 1 Day 2 File : sfd2.dat
```

Then the file, sfd1.dat, must start with

```
PartOf : Case1, Scenario 1
Day : 1
```

and the file, sfd2.data, must start with

```
PartOf : Case1, Scenario 1
Day : 2
```

Any spacing between the columns in a row is allowed. Columns must be separated by at least one space or tab, but they may contain more than one space or tab. Similarly, any extra space between the left hand margin and the first 'visible' character in a row is allowed. Although arbitrary spacing between columns may be used, we suggest a standard amount of spacing is chosen for any load scenario file to help keep it human readable.

The following snippet of a load scenario is valid.

```
...
Hour    Day    Z1    Z2
1 1 300 400
        1              2              340 440
...
```

Choosing a simulated 'true load' scenario   For each run of AMES-TS, a single Load Scenario, L_n, is chosen to function as the 'simulated true load scenario', L^*. L^* is chosen from the set of possible load scenarios L_n, $n = 1, \ldots, \text{NumLoadScenarios}$, with respect to the user supplied probabilities, $\text{Prob}(L_n)$. The scenario L^* functions as the 'true load' for the entire run of the Load Case. AMES-TS will choose a pseudo-random number from the system pseudo-random number generator to actualize a single L_n for *each* run. If AMES-TS is not run in batch mode (that is only one load scenario is simulated), and the same seed is used for each execution of AMES-TS, then the same (albeit pseudo-random) load scenario will be used for *each* execution of AMES-TS. If AMES-TS is run in batch mode for b batches, then at the start of each run_i $(i = 1, \ldots, b)$, AMES-TS will choose a new load scenario to be the 'true load', L^*, for run_i.

Assumptions of the user-supplied expected load scenario (ExpectedLoad.dat) or the default true expected loads, for a given Load Case:

1. Each load zone Z is serviced by only one Load-Serving Entity (LSE), denoted by LSE_Z.

2. The demand bid of LSE_z submitted on any day D-1 to the AMES (V4.0) day-ahead market (DAM) for the following day D takes the form of a fixed (non-price sensitive) load profile giving LSE_Z's expected load at load zone Z for each hour H of day D.

3. The demand bids of LSE_Z consist of the expected load values appearing in the load zone column Z in the expected load scenario, ExpectedLoad.dat, if provided. Otherwise, the demand bids of LSE_Z consist of the default true expected loads calculated by AMES (V4.0). By construction, these default true expected loads are correct (unbiased) expectations for the load values realized under the AMES (V4.0) simulated true load scenario L^*.

3   Example Control and Scenario File

Examples of the described files.

The Control File

```
CaseName : Example 1
NumZones : 2
NumLoadScenarios : 3
MaxDay   : 3
Scenario 1 Prob : .2
Scenario 2 Prob : .3
Scenario 3 Prob : .5
Scenario 1 File : sf1.dat
Scenario 2 File : sf2.dat
Scenario 3 File : sf3.dat
ExpectedLoad    : exload.dat
```

A single scenario file

```
//Data file for scenario number 1.
AllOf : Example 1, Scenario : 1
Day     Hour    Z1    Z2
1       1       300    400
1       2       200    300
...
1       24      240    350
...
3       1       350    400
...
3       24      400    400
```

The 'Expected' load file

```
AllOf : Example 1, ExpectedLoad
Day     Hour    Z1      Z2
1       1       320     420
1       2       220     320
...
1       24      240     350
...
3       1       350     400
...
3       24      400     420
```