Type System Unification

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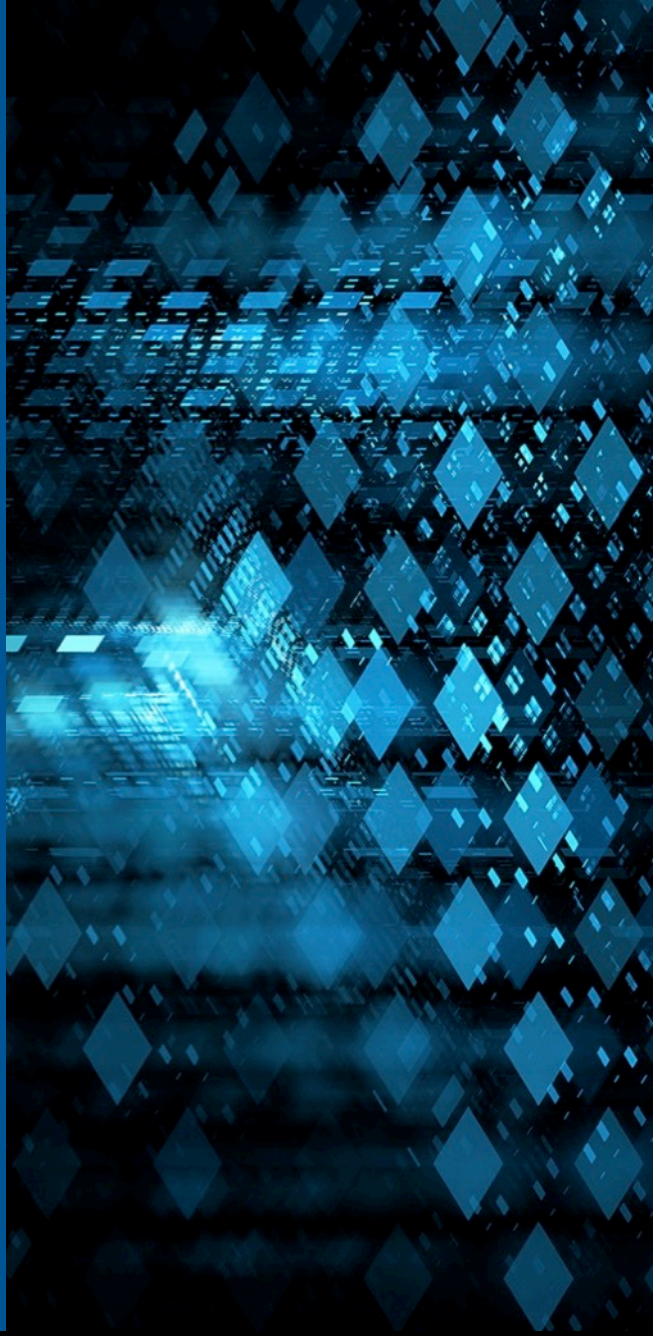

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Type System Unification

Unification of type systems and expression languages (Peter, Lutz*, Alexey, Brian, Serban)

- Alisa ReqSpec et.al.: types, assign once variables, computed variables., property types, Resolute types, Java type mapping
- Property language V3
- Constraint language
- BLESS
- Data Model annex
- Resolute, Scripting languages (Python, Ease)

Type System Unification

Types

- Data types, property types, constraint language variable types
  - Property types available as data types
  - Data types available as property types
- Base types: integer, real, string, Boolean
  - No more **aadlinteger** keyword
- Handling of units: part of value, association via property
  - Integration of proposed Units system (ISO, SysML)
  - Unit assumptions vs. units passed as part of value
- Sequences & sets: Set with unique element semantics
- Union of types
- Type conversion: explicit casting and implicit for numerics
  - Real without .0 is accepted
  - Numeric and numeric range
- Types like time: when to use integer vs. real
- Support for type inference from value? Require type

Type System Unification Approach

Common type system available for use as data types, property types, annex sublanguage types

- Types can have properties

Base types

- Numeric, Boolean, string, enumeration, units

User defined types

- Int16: **type** Integer { Data_Size => 16 Bits};
- Temperature: **type** real **units** Celsius;
- Speed: **type** integer [0 .. 200 kph] **units** SpeedUnits;

Composite types

- Unions and aggregates
- Aggregates: records, arrays, sets, multiset (bag), list(sequences), map, graph
- Personel_Record: **record** (first: string; last: Address;);

Provide subtyping

- Same as subclassing
- Equivalent of type extension for data types

Type System Usage

Port types

- P1: **in port** Temperature;

Data components

- DataObject: **data** Personel_Record;
  - Subtype substitution/match (Type_Extension)

Properties

- Property definitions reference types

Data Annex

- Characterization via properties vs. partial specification
- **Data** personel_record { Data_Representation => Struct; };
- Personel_Record: **type record** () { Source_Name => PersonnelRecord;};

- Personel_Record: **refined to type record** (first: string; last : string;);

Representation of Transferred Data

Example

- BodyTemperature: **type** integer [30..50 C] **units** TemperatureUnits;
- P1: **out port** BodyTemperature;

Is unit included in transferred data or is a unit assumed?

Non-zero reference point for transferred value

Transfer representation may be different from in memory representation

Alternatives:

- Protocol specification
  - As virtual bus
  - Mapping into bit representation (see 429 protocol example in SAVI demo)
- Assumed unit as property on port

Representation of Types

Example

- BodyTemperature: **type** integer [30..50 C] **units** TemperatureUnits;
- P1: **out port** BodyTemperature;

Digital representation

- Base_Type property in Data_Model
- Associated with type or with port

Physical representation

- Dynamic behavior
- Specified as part of type or specific to each use site
  - Associated with feature