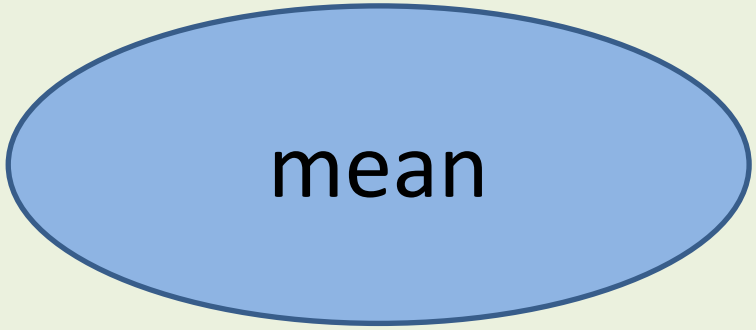
SBML Level 3 Math Packages

Sarah Keating

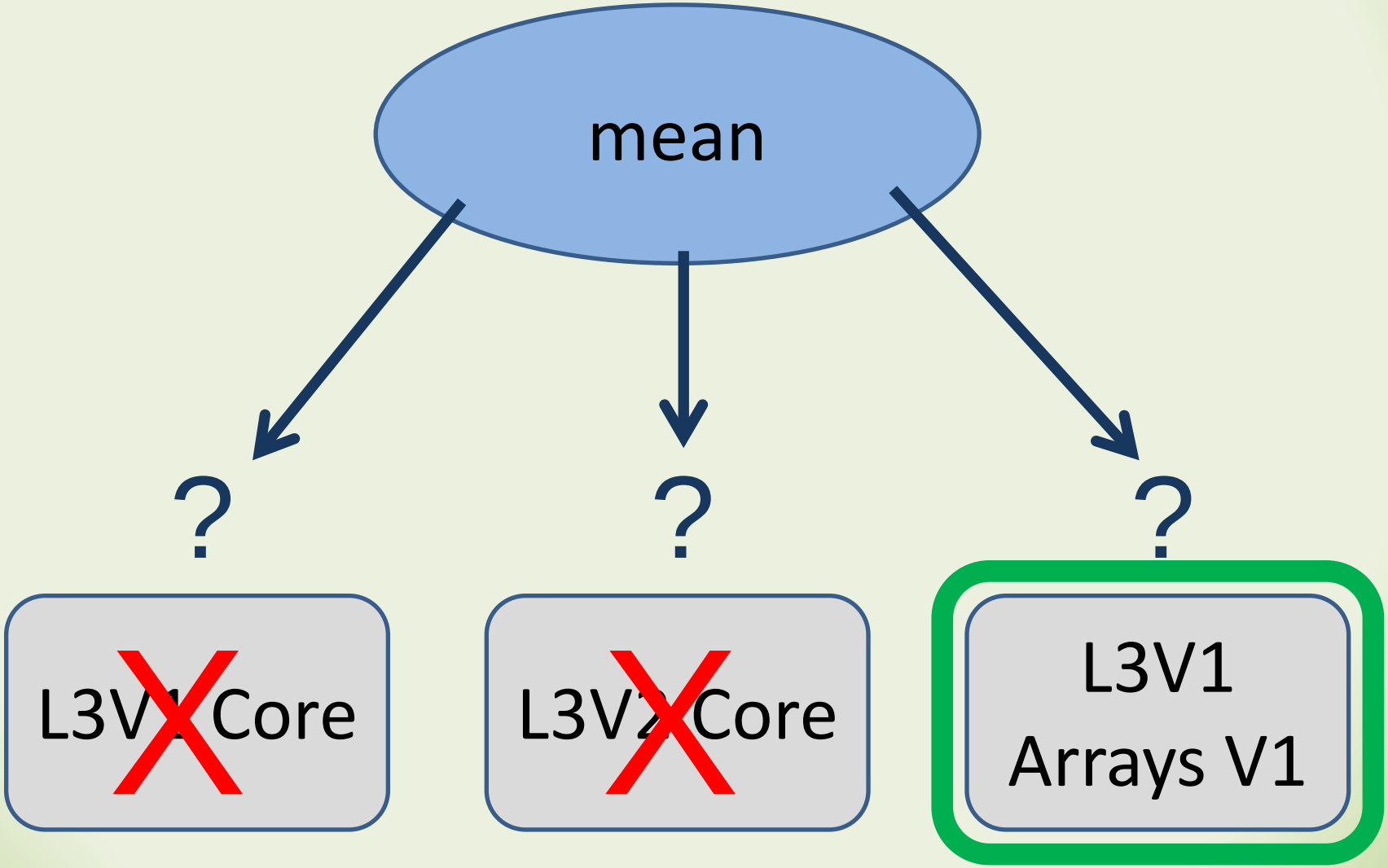
Math in SBML

- Limited subset of MathML
- L3V2 core may add further constructs
- Packages can add MathML as needed

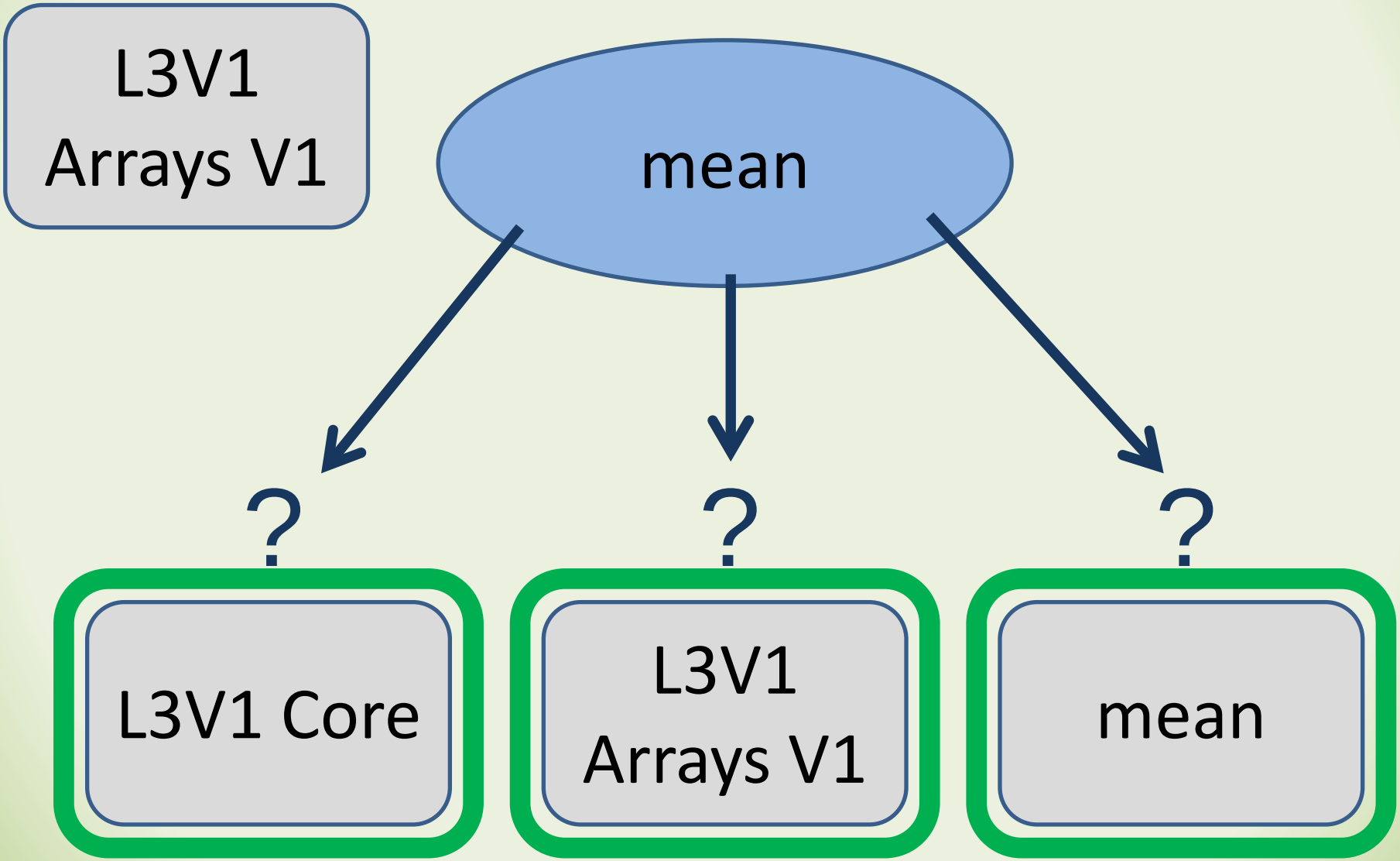
Need to use a math construct



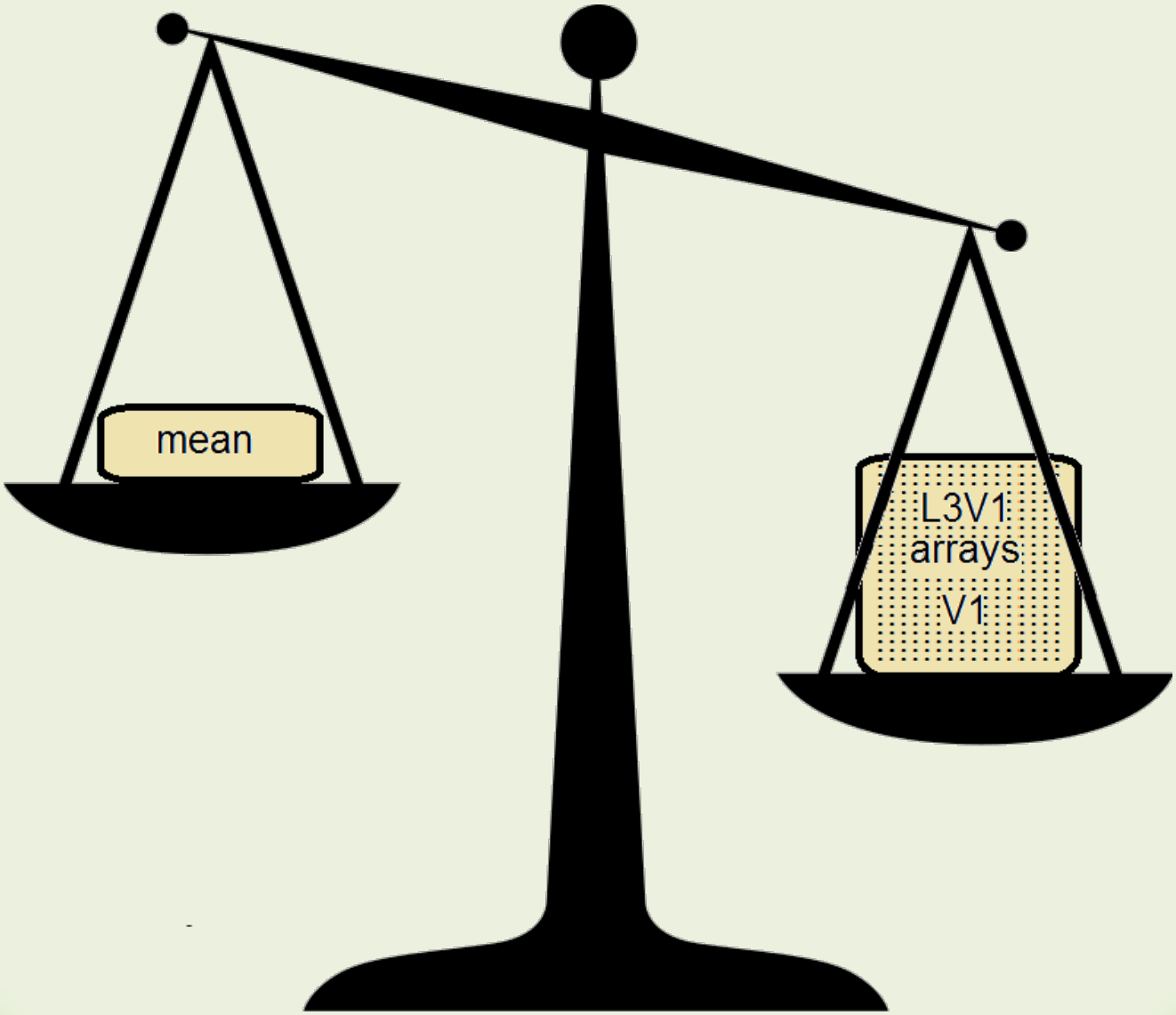
Where is it specified ?



Software supporting it ?



Software wanting to support it ?



SBML Level 3 Packages

Package name & link to info page	Label	Description	Status
Annotations	annot	Support for richer annotation syntax than the regular annotations in SBML Level 3 Core	Stalled
Arrays	arrays	Support for expressing arrays of things	Draft available
Hierarchical Model Composition	comp	A means for defining how a model is composed from other models	Released
Distributions	distrib	Support for encoding models that sample values from statistical distributions	Draft available
Dynamic Structures	dyn	Support for creating and destroying entities during a simulation	Stalled
Flux Balance Constraints	fbc	Support for constraint-based (a.k.a. steady-state) models	Released
Groups	groups	A means for grouping elements	Draft available
Layout	layout	Support for storing the spatial topology of a network diagram; adjunct to the render package	Released
Multistate and Multicomponent Species	multi	Object structures for representing entity pools with multiple states and composed of multiple components, and reaction rules involving them	Draft available
Qualitative Models	qual	Support for models wherein species do not represent quantity of matter & processes are not reactions per se	Released
Rendering	render	Support for defining the graphical symbols and glyphs used in a diagram of the model; adjunct to the layout package	Draft available
Required Elements	req	Support for fine-grained indication of SBML elements that have been changed by the presence of another package	Draft available
Spatial Processes	spatial	Support for describing processes that involve a spatial component, and describing the geometries involved	Draft available

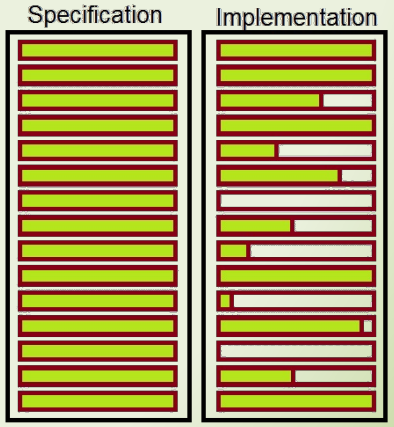
Limited subset of MathML

Way forward …

- Allow any MathML

Huge burden on software development

Mismatch between specification and implementation

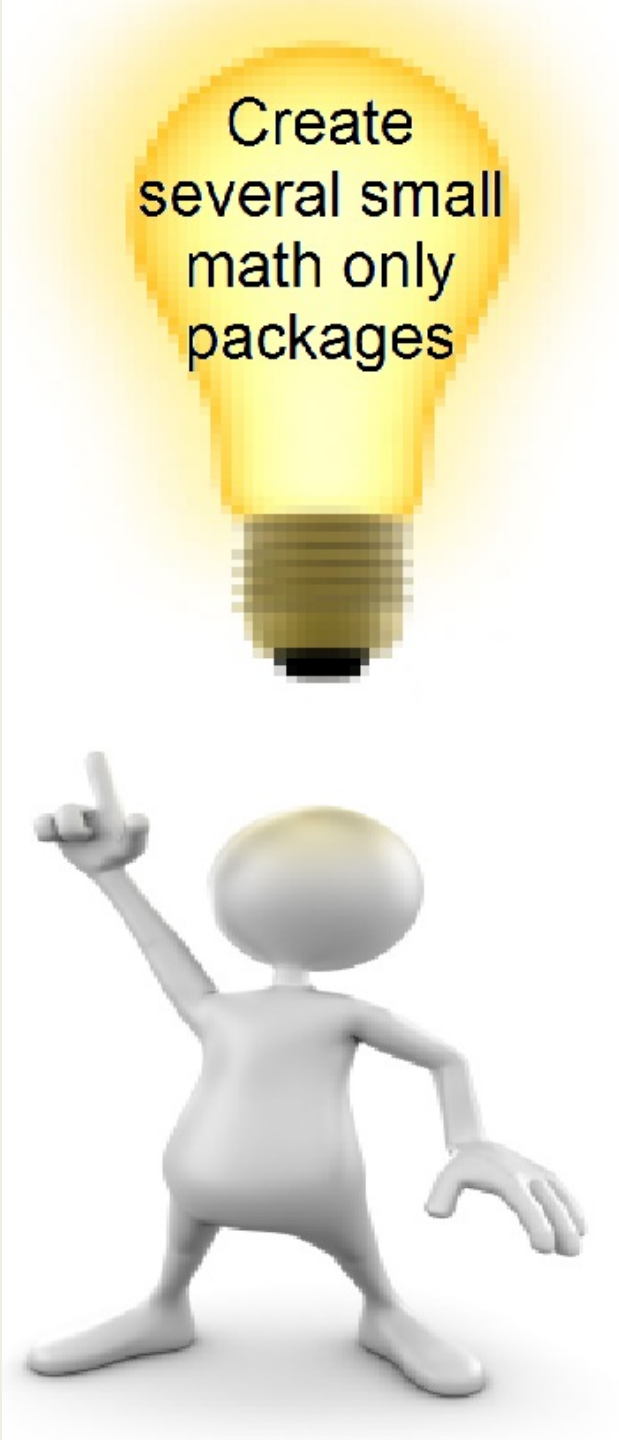


Way forward …

- Allow any MathML
- Put useful functions into L3V2 core

Discussed at HARMONY

Radical thought …



Radical thought …

- Group similar MathML constructs into small math package
  - e.g. vectors/stats
- Core/Packages do not extend MathML
  - depend on necessary math package
  - e.g. arrays would depend on ‘vectors’

Advantages

- Any math construct is only defined once but can be used by any package that requires it

- Additional math in packages would be usable with L3V1

- Developers will have smaller targets to support

Possible packages

Additional content elements

interval

Extra arithmetic

quotient (L3V2?)
max
min
rem (L3V2?)
implies (L3V2?)
gcd
lcm (MathML 2.0)

Extra logic

condition
forall
exists

Theory of sets

emptyset (MathML2.0)
set
list
union
intersect
in
notin
subset
prsubset
notsubset
notprsubset
setdiff
card (MathML 2.0)
cartesianproduct (MathML 2.0)

Sum and product

lowlimit
uplimit
sum
product

Possible packages

Statistics	
mean	sdev
variance	median
mode	moment
momentabout (MathML 2.0)	

Array math
vector
selector

Linear algebra	
matrix	matrixrow
inverse	determinant
transpose	
vectorproduct (MathML 2.0)	
scalarproduct (MathML 2.0)	
outerproduct (MathML 2.0)	