

Subject: Problems with named constants

From: Van Snyder

Since Fortran 90, one has been able to define the length of a character named constant from the value assigned to it, e.g.

```
character(len=*), parameter :: myParameter = 'myValue'
```

defines a character named constant of length 7.

Character length is defined to be a nonkind type parameter.

For consistency, it may be desirable that any of the nonkind type parameters of a named constant can be taken from its data. E.g. it would be desirable to be able to write

```
type(myParam) :: myType
  integer, nonkind :: myParam
  ...
end type myType
type(myType(*)), parameter :: myValue = myType(large_icky_expression)(...)
```

I have a program in which a module contains an array of nearly a thousand elements that it would like to make available for examination, but not for changing. In fact, there's no need even for the module in which the array is declared to change it. Not having READONLY variables, and not wanting to write an access function for something examined as frequently as is this array, I would like to make it a named constant.

There are two problems:

- Specifying the value requires far more than the maximum number of continuation lines. Unlike variables, one can't specify the value of a named constant with an unlimited number of DATA statements. So one needs to decompose the value into a series of values, each that are small enough to be specified within the maximum number of continuations, and then concatenate the values by putting the names of the parts into an array constructor. This problem would be ameliorated by allowing a larger, preferably unlimited, number of lines per statement.
- One needs to count the values to specify the array dimension. This makes both maintenance and initial development tedious and error-prone.

This problem would be ameliorated if the named constant could have "assumed size."

Here's a real example of what I'd like to do:

```
integer, parameter :: TypeTable(*) = (/ &
  begin, t+t_griddedOrigin, l+l_climatology, l+l_dao, l+l_ncep, n+n_dt_def, &
  begin, t+t_criticalModule, l+l_both, l+l_either, l+l_ghz, l+l_neither, &
    l+l_thz, n+n_dt_def, &
  begin, t+t_fillMethod, l+l_apriori, l+l_explicit, l+l_hydrostatic, &
    l+l_l1b, l+l_l2aux, l+l_l2gp, l+l_vector, l+l_special, n+n_dt_def, &
  begin, t+t_hGridType, l+l_explicit, l+l_fixed, l+l_fractional, &
    l+l_height, l+l_linear, n+n_dt_def, &
  begin, t+t_matrix, l+l_plain, l+l_cholesky, l+l_kronecker, l+l_spd, &
    n+n_dt_def, &
  begin, t+t_mergeMethod, l+l_direct, l+l_weighted, n+n_dt_def, &
```

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begin, t+t_mergeSource, l+l_dao, l+l_ncep, n+n_dt_def, &
begin, t+t_module, l+l_ghz, l+l_thz, n+n_dt_def, &
begin, t+t_molecule, l+(/ (i,i=first_molecule, last_molecule) /), &
n+n_dt_def, &
begin, t+t_outputType, l+l_l2aux, l+l_l2gp, n+n_dt_def, &
begin, t+t_quantityType, l+l_baseline, l+l_earthRefl, l+l_elevOffset, &
l+l_extinction, l+l_gph, l+l_losVel, l+l_orbitIncline, l+l_ptan,&
l+l_radiance, l+l_refGPH, l+l_scECI, l+l_scVel, l+l_scGeocAlt, &
l+l_spaceRadiance, l+l_temperature, l+l_tngtECI, l+l_tngtGeodAlt, &
l+l_tngtGeocAlt, l+l_vmr, n+n_dt_def, &
begin, t+t_scale, l+l_apriori, & ! l+l_covariance, & !??? Later !???
l+l_none, l+l_norm, n+n_dt_def, &
begin, t+t_species, l+l_gph, l+l_gph_precision, l+l_temperature, &
l+l_temperature_prec, n+n_dt_def, &
begin, t+t_units, l+l_days, l+l_deg, l+l_degrees, &
l+l_dimensionless, l+l_dimless, l+l_dl, l+l_ghz, &
l+l_hours, l+l_hpa, l+l_hz, l+l_k, l+l_khz, l+l_km, l+l_logp, &
l+l_m, l+l_maf, l+l_mafs, l+l_mb, l+l_meters, l+l_mhz, &
l+l_mif, l+l_mifs, l+l_minutes, l+l_orbits, l+l_pa, l+l_ppbv, &
l+l_ppmv, l+l_pptv, l+l_rad, l+l_radians, l+l_s, l+l_seconds, &
l+l_thz, l+l_vmr, l+l_zeta, n+n_dt_def, &
begin, t+t_vgridcoord, l+l_angle, l+l_geodAltitude, l+l_gph, l+l_none, &
l+l_pressure, l+l_theta, l+l_zeta, n+n_dt_def, &
begin, t+t_vgridtype, l+l_explicit, l+l_linear, l+l_logarithmic, &
n+n_dt_def, &
begin, s+s_time, np+n_spec_def, &
begin, s+s_gridded, &
begin, f+f_file, t+t_string, n+n_field_type, &
begin, f+f_field, t+t_string, n+n_field_type, &
begin, f+f_origin, t+t_griddedOrigin, n+n_field_type, &
np+n_spec_def, &
begin, s+s_create, &
begin, f+f_template, n+n_field_type, &
begin, f+f_copy, n+n_field_type, &
begin, f+f_autofill, n+n_field_type, &
np+n_spec_def, &
begin, s+s_hGrid, &
begin, f+f_type, t+t_hGridType, nr+n_field_type, &
begin, f+f_module, s+s_module, nr+n_field_spec, &
begin, f+f_fraction, t+t_numeric, n+n_field_type, &
begin, f+f_height, t+t_numeric, n+n_field_type, &
begin, f+f_mif, t+t_numeric, n+n_field_type, &
begin, f+f_interpolationfactor, t+t_numeric, n+n_field_type, &
begin, f+f_values, t+t_numeric, n+n_field_type, &
ndp+n_spec_def, &
begin, s+s_merge, & ! Must be AFTER S_Gridded
begin, f+f_apriori, s+s_gridded, n+n_field_spec, &
begin, f+f_source, t+t_mergeSource, n+n_field_type, &
begin, f+f_species, t+t_species, n+n_field_type, &
begin, f+f_range, t+t_numeric_range, n+n_field_type, &
begin, f+f_height, t+t_numeric, n+n_field_type, &
begin, f+f_method, t+t_mergeMethod, n+n_field_type, &
begin, f+f_scale, t+t_numeric, n+n_field_type, &
np+n_spec_def, &

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begin, s+s_template, &
  begin, f+f_copy, n+n_field_type, &
  begin, f+f_apriori, n+n_field_type, &
  begin, f+f_autofill, n+n_field_type, &
  np+n_spec_def, &
begin, s+s_vgrid, &
  begin, f+f_type, t+t_vGridType, nr+n_field_type, &
  begin, f+f_coordinate, t+t_vGridCoord, nr+n_field_type, &
  begin, f+f_number, t+t_numeric, n+n_field_type, &
  begin, f+f_per_decade, t+t_numeric, n+n_field_type, &
  begin, f+f_start, t+t_numeric, n+n_field_type, &
  begin, f+f_stop, t+t_numeric, n+n_field_type, &
  begin, f+f_values, t+t_numeric, n+n_field_type, &
  ndp+n_spec_def, &
begin, s+s_quantity, & ! Must be AFTER s_hgrid and s_vgrid
  begin, f+f_hGrid, s+s_hgrid, n+n_field_spec, &
  begin, f+f_vGrid, s+s_vgrid, n+n_field_spec, &
  begin, f+f_molecule, t+t_molecule, n+n_field_type, &
  begin, f+f_radiometer, s+s_radiometer, n+n_field_spec, &
  begin, f+f_module, s+s_module, n+n_field_spec, &
  begin, f+f_signal, s+s_signal, n+n_field_spec, &
  begin, f+f_type, t+t_quantityType, n+n_field_type, &
  begin, f+f_unit, t+t_units, n+n_field_type, &
  np+n_spec_def, &
begin, s+s_vectorTemplate, & ! Must be AFTER s_quantity
  begin, f+f_quantities, s+s_quantity, n+n_field_spec, &
  begin, f+f_signals, t+t_string, n+n_field_type, &
  np+n_spec_def, &
begin, s+s_vector, & ! Must be AFTER s_vectorTemplate
  begin, f+f_template, s+s_vectorTemplate, n+n_field_spec, &
  ndp+n_spec_def, &
begin, s+s_l2gp, & ! Must be AFTER s_vector
  begin, f+f_source, s+s_vector, f+f_template, f+f_quantities, &
    n+n_dot, &
  begin, f+f_file, t+t_string, n+n_field_type, &
  begin, f+f_compareOverlaps, t+t_boolean, n+n_field_type, &
  begin, f+f_outputOverlaps, t+t_boolean, n+n_field_type, &
  begin, f+f_swath, t+t_string, n+n_field_type, &
  ndp+n_spec_def, &
begin, s+s_l2aux, & ! Must be AFTER s_vector
  begin, f+f_source, s+s_vector, f+f_template, f+f_quantities, &
    nr+n_dot, &
  begin, f+f_compareOverlaps, t+t_boolean, n+n_field_type, &
  begin, f+f_outputOverlaps, t+t_boolean, n+n_field_type, &
  begin, f+f_file, t+t_string, n+n_field_type, &
  begin, f+f_sdname, t+t_string, n+n_field_type, &
  ndp+n_spec_def, &
begin, s+s_matrix, & ! Must be AFTER s_vector
  begin, f+f_rows, s+s_vector, n+n_field_spec, &
  begin, f+f_columns, s+s_vector, n+n_field_spec, &
  begin, f+f_type, t+t_matrix, n+n_field_type, &
  np+n_spec_def, &
begin, s+s_fill, & ! Must be AFTER s_vector, s_matrix and
  ! s_climatology

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begin, f+f_quantity, s+s_vector, f+f_template, f+f_quantities, &
    nr+n_dot, &
begin, f+f_matrix, s+s_matrix, n+n_field_spec, &
begin, f+f_method, t+t_fillmethod, nr+n_field_type, &
begin, f+f_sourceQuantity, s+s_vector, f+f_template, &
    f+f_quantities, n+n_dot, &
begin, f+f_scVel, s+s_vector, f+f_template, f+f_quantities, &
    n+n_dot, &
begin, f+f_scECI, s+s_vector, f+f_template, f+f_quantities, &
    n+n_dot, &
begin, f+f_tngtECI, s+s_vector, f+f_template, f+f_quantities, &
    n+n_dot, &
begin, f+f_temperatureQuantity, s+s_vector, f+f_template, &
    f+f_quantities, n+n_dot, &
begin, f+f_h2oQuantity, s+s_vector, f+f_template, f+f_quantities, &
    n+n_dot, &
begin, f+f_geocAltitudeQuantity, s+s_vector, f+f_template, &
    f+f_quantities, n+n_dot, &
begin, f+f_refGPHQuantity, s+s_vector, f+f_template, &
    f+f_quantities, n+n_dot, &
begin, f+f_sourceL2GP, s+s_l2gp, n+n_field_spec, &
begin, f+f_sourceL2AUX, s+s_l2aux, n+n_field_spec, &
begin, f+f_sourceApriori, s+s_apriori, n+n_field_spec, &
begin, f+f_spread, t+t_boolean, n+n_field_type, &
begin, f+f_maxIterations, t+t_numeric, n+n_field_type, &
begin, f+f_explicitValues, t+t_numeric, n+n_field_type, &
    ndp+n_spec_def, &
begin, s+s_output, & ! Must be AFTER s_l2aux and s_l2gp
begin, f+f_type, t+t_outputType, nr+n_field_type, &
begin, f+f_file, t+t_string, nr+n_field_type, &
begin, f+f_quantities, s+s_l2aux, s+s_l2gp, n+n_field_spec, &
begin, f+f_overlaps, s+s_l2aux, s+s_l2gp, n+n_field_spec, &
    ndp+n_spec_def, &
begin, s+s_subset, & ! Must be AFTER s_vector
begin, f+f_quantity, s+s_vector, f+f_template, &
    f+f_quantities, nr+n_dot, &
begin, f+f_test, s+s_vector, f+f_template, &
    f+f_quantities, nr+n_dot, &
begin, f+f_channels, t+t_numeric, n+n_field_type, &
begin, f+f_criteria, t+t_numeric, nr+n_field_type, &
    ndp+n_spec_def, &
begin, s+s_forwardModel, & ! Must be AFTER s_vector and s_matrix
    ndp+n_spec_def, &
begin, s+s_forwardModelGlobal, &
begin, f+f_atmos_der, t+t_boolean, n+n_field_type, &
begin, f+f_do_conv, t+t_boolean, n+n_field_type, &
begin, f+f_do_freq_avg, t+t_boolean, n+n_field_type, &
begin, f+f_frequency, t+t_numeric, n+n_field_type, &
begin, f+f_spect_der, t+t_boolean, n+n_field_type, &
begin, f+f_temp_der, t+t_boolean, n+n_field_type, &
    ndp+n_spec_def, &
begin, s+s_retrieve, & ! Must be AFTER s_vector and s_matrix
begin, f+f_apriori, s+s_vector, n+n_field_spec, &
begin, f+f_aprioriScale, t+t_numeric, n+n_field_type, &

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begin, f+f_columnScale, t+t_scale, n+n_field_type, &
begin, f+f_covariance, s+s_matrix, n+n_field_spec, &
begin, f+f_diagonal, t+t_boolean, n+n_field_type, &
begin, f+f_diagonalOut, t+t_boolean, n+n_field_type, &
begin, f+f_fwdModelExtra, s+s_vector, nr+n_field_spec, &
begin, f+f_fwdModelIn, s+s_vector, nr+n_field_spec, &
begin, f+f_fwdModelOut, s+s_vector, n+n_field_spec, &
begin, f+f_jacobian, s+s_matrix, n+n_field_spec, &
begin, f+f_maxIterations, t+t_numeric, n+n_field_type, &
begin, f+f_measurements, s+s_vector, nr+n_field_spec, &
begin, f+f_method, t+t_method, n+n_field_type, &
begin, f+f_outputCovariance, s+s_matrix, n+n_field_spec, &
begin, f+f_state, s+s_vector, nr+n_field_spec, &
begin, f+f_toleranceA, t+t_numeric, n+n_field_type, &
begin, f+f_toleranceF, t+t_numeric, n+n_field_type, &
begin, f+f_toleranceR, t+t_numeric, n+n_field_type, &
begin, f+f_weight, s+s_vector, n+n_field_spec, &
ndp+n_spec_def, &
begin, s+s_sids, & ! Must be AFTER s_vector and s_matrix
begin, f+f_fwdModelExtra, s+s_vector, nr+n_field_spec, &
begin, f+f_fwdModelIn, s+s_vector, nr+n_field_spec, &
begin, f+f_fwdModelOut, s+s_vector, nr+n_field_spec, &
begin, f+f_jacobian, s+s_matrix, n+n_field_spec, &
ndp+n_spec_def, &
begin, s+s_snoop, &
begin, f+f_comment, t+t_string, n+n_field_type, &
nd+n_spec_def, & !???
begin, s+s_l2load, & !???
begin, f+f_bill, t+t_string, n+n_field_type, & !???
begin, f+f_zvi, t+t_string, n+n_field_type, & !???
nadp+n_spec_def, &
begin, z+z_mlsSignals, s+s_module, s+s_band, s+s_radiometer, &
s+s_signal, s+s_spectrometerType, &
n+n_section, &
begin, z+z_globalsettings, &
begin, p+p_version_comment, t+t_string, n+n_name_def, &
begin, p+p_input_version_string, t+t_string, n+n_name_def, &
begin, p+p_output_version_string, t+t_string, n+n_name_def, &
begin, p+p_allow_climatology_overloads, t+t_boolean, &
n+n_name_def, &
s+s_time, &
s+s_l2load, s+s_forwardModelGlobal, & !???
n+n_section, &
begin, z+z_readapriori, s+s_time, s+s_gridded, s+s_l2gp, &
s+s_l2aux, s+s_snoop, n+n_section, &
begin, z+z_mergeapriori, s+s_time, s+s_merge, n+n_section, &
begin, z+z_chunkdivide, &
begin, p+p_critical_bands, t+t_string, n+n_name_def, &
begin, p+p_critical_scanning_modules, t+t_criticalModule, &
n+n_name_def, &
begin, p+p_home_geod_angle, t+t_numeric, n+n_name_def, &
begin, p+p_home_module, t+t_module, n+n_name_def, &
begin, p+p_ideal_length, t+t_numeric, n+n_name_def, &
begin, p+p_max_gap, t+t_numeric, n+n_name_def, &

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begin, p+p_overlap, t+t_numeric, n+n_name_def, &
begin, p+p_scan_lower_limit, t+t_numeric_range, n+n_name_def, &
begin, p+p_scan_upper_limit, t+t_numeric_range, n+n_name_def, &
n+n_section, &
begin, z+z_construct, s+s_time, s+s_vgrid, s+s_hgrid, s+s_quantity, &
s+s_vectortemplate, s+s_snoop, n+n_section, &
begin, z+z_fill, s+s_time, s+s_vector, s+s_create, &
s+s_fill, s+s_matrix, s+s_snoop, &
n+n_section, &
begin, z+z_retrieve, s+s_matrix, s+s_forwardModel, s+s_retrieve, &
s+s_subset, s+s_sids, s+s_time, n+n_section, &
begin, z+z_join, s+s_time, s+s_l2gp, s+s_l2aux, n+n_section, &
begin, z+z_output, s+s_time, s+s_output, n+n_section /)
```

To remain standard-conforming, this parameter declaration is decomposed into numerous other parameter declarations, each of which can be specified within the maximum number of allowed continuation lines, and the final value is constructed by concatenating these smaller named values. As you can imagine, it is tedious to count the number of elements in each one. Every time a change is needed, the sizes must be counted again, and added up to make the size of the actually-wished-for object. The module containing this data structure is on version 2, step 50. I don't remember how many steps there were in version 1.

Today, there are 810 elements in the array (I think – why don't you count them, just to make sure). Tomorrow, I'll need to make a change, and count them again. There are 240 lines in this statement, so I need to break it into at least six parts. This will be reduced to three in Fortran 2000, but one would be better. I'd sure love it if I could write in my program what I wrote here.