The ERS Soar Kernel API

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Objectives

- Export only needed information
- Completely decouple user interface layer from kernel (provide generic plug-ins)
- Enable kernel to be embedded (no UI)
- Make kernel thread-safe
- Allow, but discourage, circumvention

Global Data

- n All global data removed from kernel
  - – except a few read-only items initialized at compile-time
- n Those globals added to agent structure
- n Removed current_agent macro (expanded to current_agent->foo)
- n Added agent pointer as parameter to functions referencing global data

Tcl Isolation

n All direct calls from kernel to UI removed

n Tcl data structures removed from kernel agent structure

n A generic data pointer provided in agent structure and passed to some callbacks

n A tcl_interface_data structure created outside the kernel used to track Tcl info (e.g., Tcl_Interp and Tk_Window)

Embedding

n Allow kernel to operate without UI

n Move bootstrapping functions inside kernel

   – Binary rule load

n Ensure normal I/O can be disabled

n Proven through demo with simple main driver

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Opaque Types

- n Created for
  - agents   `psa`
  - symbols   `pss`
  - productions   `psp`
  - working memory elements   `psw`
- n Better encapsulation
- n Code referencing internals moved inside

Prototypes

- n Identified by common prefix: `Sk_`
- n Names in mixed case after prefix
- n Only data types mentioned in soarkernel.h allowed in signature
- n Includes accessor functions for internal data
- n e.g., `extern psa Sk_GetAgentNamed (char * name);`

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Header Files

soarkernel.h reorganized into:

n soarkernel.h

Only externally visible types and prototypes

n sk_int.h

Globally visible within kernel

n *.h

Exported by file to others within kernel

What is exported?

- Opaque types (4): psa, pss, psp, psw
- Enumerations (12): types for lexer, symbols, matches, traces, productions, callbacks
- I/O structures
- RHS function type
- 155 function prototypes

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Exported Prototypes

- Callbacks
- RHS functions
- Agents
- Sysparams
- Working Memory
- Execution
- Problem Spaces
- Lexer

- Parser
- Symbols
- I/O
- Printing
- Performance Measures
- Explanations
- Tracing
- Debugging

Circumvention

- n Include internal header files, such as `sk_int.h` or `rete.h`

- n Cast opaque types such as `(psa)` to the corresponding internal type such as `(agent *)`

- n Dereference to desired field

Status

- n **Nuggets of Gold**
  - Several significant enhancements to Soar kernel
  - Copy of ERS Soar kernel given to CMU
  - Awaits Integration

- n **Lumps of Coal**
  - Will require substantial work to integrate