MUX and MxN: A Revelation…

(a.k.a. “Collective” is Dead? :-o)

James Arthur Kohl

David E. Bernholdt

Oak Ridge National Laboratory

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(a date which will live in infamy…?)

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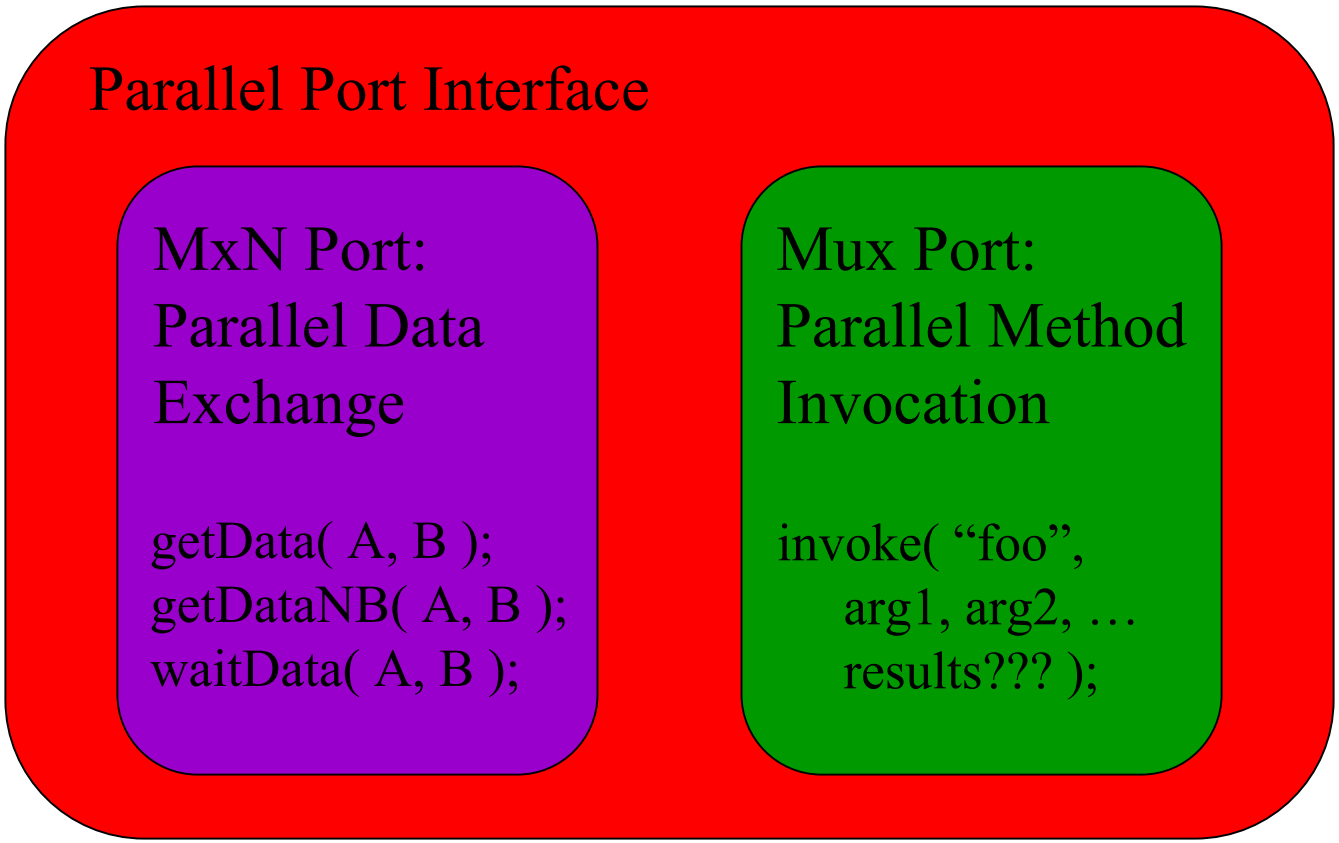
The Often Overlooked Duality…

- What is "Collective" Really?
  - ⇒ Dealing with Parallel Components
  - ⇒ Coupling Disparate Parallel Models
  - ⇒ Interfacing to Serial Components
- Two Sides:
  - ⇒ Parallel Data Exchange
  - ⇒ Parallel Method Invocation
- These are ***Distinct*** Issues
  - ⇒ Need to be Handled Separately

The Big Picture

- Interfacing Parallel Components:
  - ⇒ Exchanging and Extracting Data
    - → MxN Data Translation
    - → Other Convolutions: Grid, Temporal, Units…
      - * Outside of Parallel Paradigm, But Required & Related…
  - ⇒ Invoking Methods on Parallel Components
    - → Selective / Multiple Invocations
    - → Passing Arguments / Returning Value(s)…
- Common Issues
  - ⇒ Synchronization & Scheduling

Parallel Port Interface



Integrated MxN Port Interface

(No More coupleDataFields( )…)

```
class MxN : Port {
    virtual void registerData( Data A );
    virtual void unregisterData( Data A );
    // (Data Properties: synch)
    virtual int getData( Data A, Data B );
    virtual int getDataNonBlocking( A, B );
    virtual void waitData( A, B );
    virtual void releaseData( A, B );
    // Port Properties: freq, init_synch, run_synch…
}
```

MxN Port Properties

- Freq ~ Data Exchange Frequency
  - ⇒ 0: one-shot, send/receive model (PAWS)
  - ⇒ > 0: persistent conn, loose synch (CUMULVS)
- Init_Synch ~ Override Initial Default Synch
  - ⇒ Parallel Data Object Sets "synch" Required
- Run_Synch ~ Optimize Run-Time Synch
  - ⇒ Maintain Synch with All Parallel Tasks, versus
  - ⇒ Just Maintain Synch with Relevant Tasks
    - → Trade Off (Re)Attachment vs. Persistent Overhead…

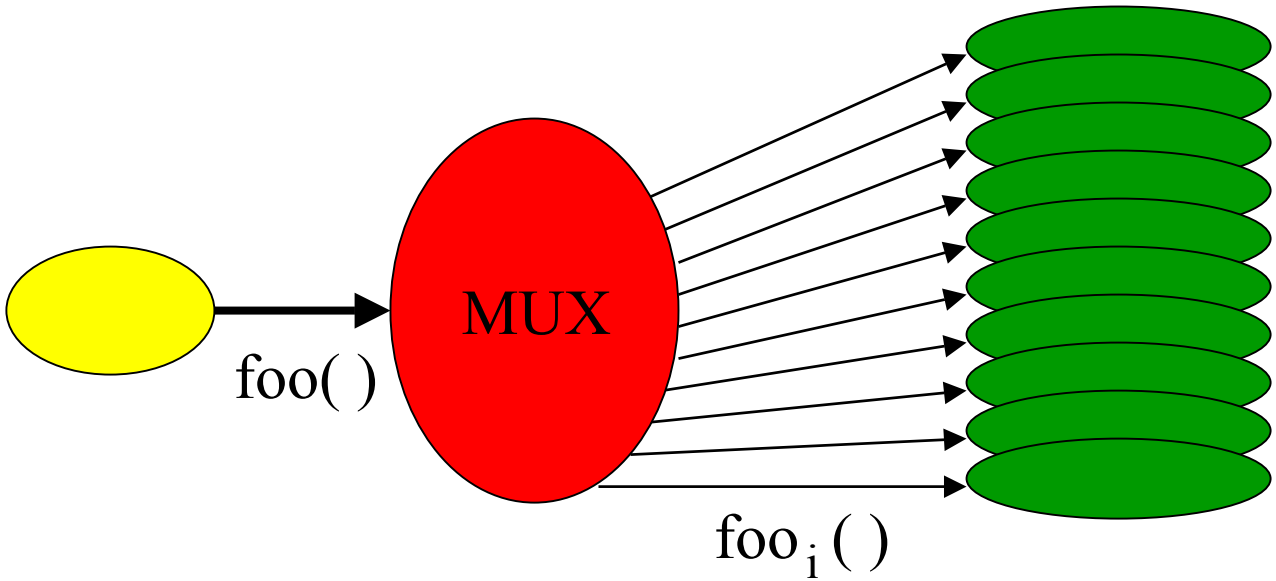
What About “DataFields”?

- Leave it to the Data Object Interfaces…
- MxN can use generic info from:
  - ⇒ Distributed Data Decompositions
  - ⇒ Processor Topology & Allocation
  - ⇒ Mesh / Grid Type
  - ⇒ Data Field Times & Periods
  - ⇒ setReady( )

Parallel Invocation Multiplexer (MUX)

- Coordinates Invocations of Methods on Parallel Components

  $\Rightarrow$ Intermediary Component Schedules Calls



Possible MUX Interfaces…

- invokeAll(“foo”, args, …, results???);
  - ⇒ Call Method on Each Parallel Instance
  - ⇒ Pass Scalar or Parallel (Indexed) Arguments?
  - ⇒ Vector of Results Collected & Returned?
- invokeOne(“foo”, …);
  - ⇒ Select One Instance to Execute Method
  - ⇒ Use Port Properties for Selection Policy?

MUX Synchronization
(invokeAll( ) Only)

- Does the Parallel Invocation Cooperate?
  - ⇒ Require Full / Loose Synchronization Among Parallel Instances?
  - ⇒ Communication Among Instances in “foo( )” ?
  - ⇒ Data Consistency Across Invocations?
- Invocation Order / Servicing Multiple Requests
  - ⇒ Interleave Different Invocations? Policy…
- Results Reductions
  - ⇒ Produce Single Result from Many ~ Voting?

One More Can of Worms…!

- Explicit versus Implicit Parallel Port Handling
  - ⇒ Both Approaches Desirable
  - ⇒ Both Interfaces Utilize the Same Underlying Implementation
- Several Approaches:
  - ⇒ SIDL / Babel (next up – Gary ☺)
  - ⇒ Pluggable Framework Services…

Pluggable Framework Services

- Instantiate Alternate “Handlers” at Run Time
- Implicit MxN / MUX:
  - ⇒ Need “Method Invocation Handler” Interface
  - ⇒ Intercept Invocations on Ports
    - → Insert Automatic MxN Data Extraction for Arguments
  - ⇒ Event-Based or Not?
  - ⇒ Services→addHandler(“Invocation”, MxN→handle( ));
- Likely Other Uses / Pluggable Services
  - ⇒ Improves Portability / Eases Framework Dvlpmt

Summary

- Separate Concerns:
  - $\Rightarrow$ MxN Interface ~ Parallel Data Exchange
  - $\Rightarrow$ MUX Interface ~ Parallel Method Invocation
- Simplify Interfaces → Rely on Data Objects
- Pluggable Framework Services?