MxN Quick

Status Update… ☺

Valley View Lodge, Townsend, TN
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(representing the whole "MxN Gang"…!)

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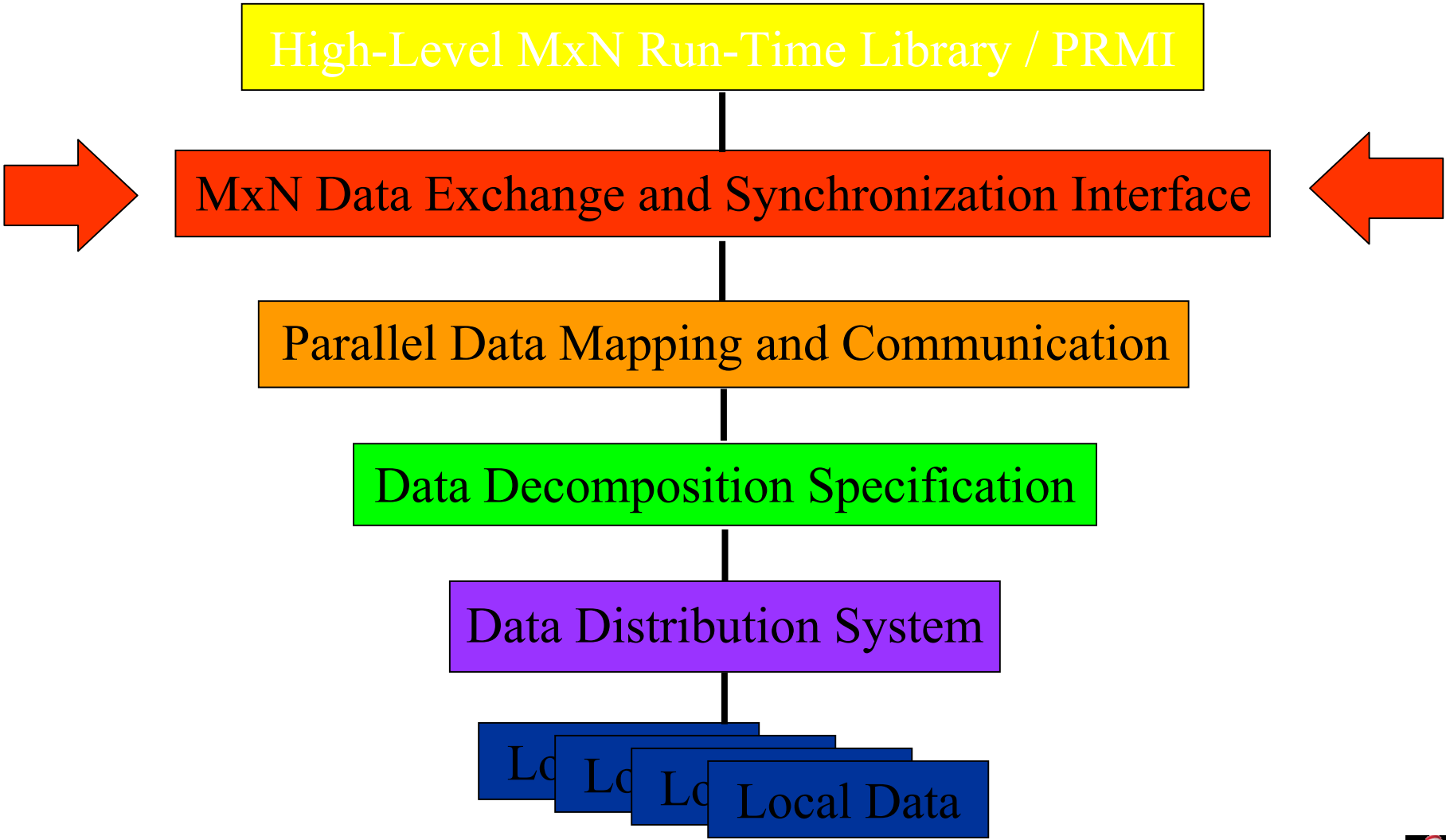
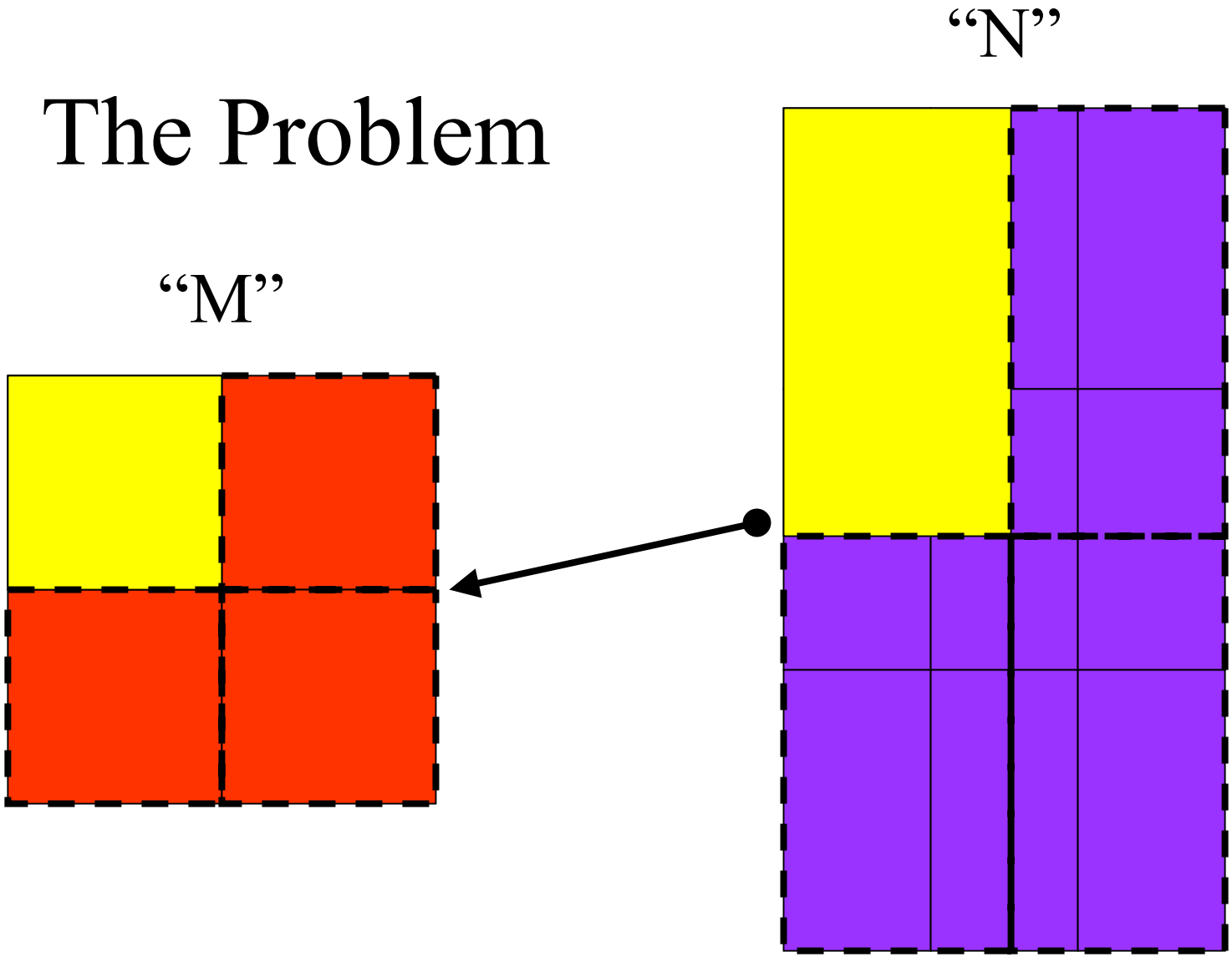
“MxN” Parallel Data Redistribution

- Share Data Among Coupled Parallel Models
  - ⇒ E.g. Ocean & Atmosphere, Visualization (“Mx1”)
- Encapsulate Existing Technologies:
  - ⇒ CUMULVS (ORNL), PAWS (LANL), Others…
  - ⇒ Data Decompositions, Communication Schedules, Connections & Synchronization Protocols…
- Foundation for “General” Coupling (Later…!)
  - ⇒ Mapping & Interpolation of Parallel Data is **Hard**.
    - Different Grids, Spatial & Temporal, Units, ad infinitum.

MxN Internal Structure

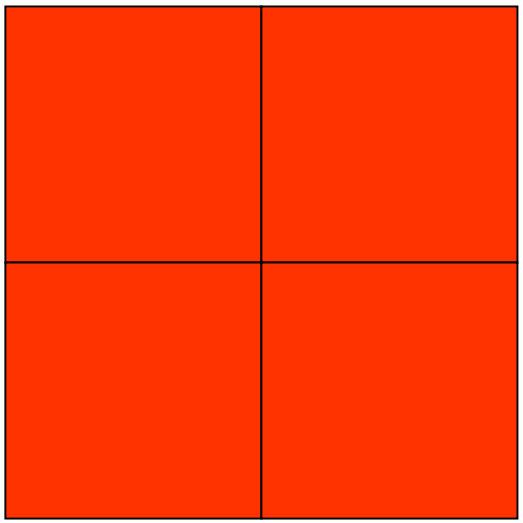


The Problem

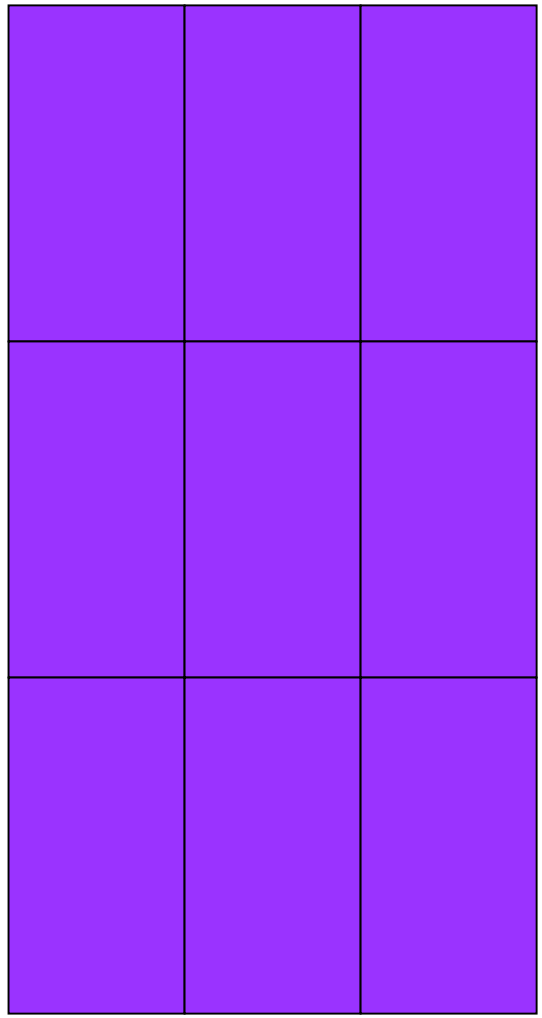


The Problem

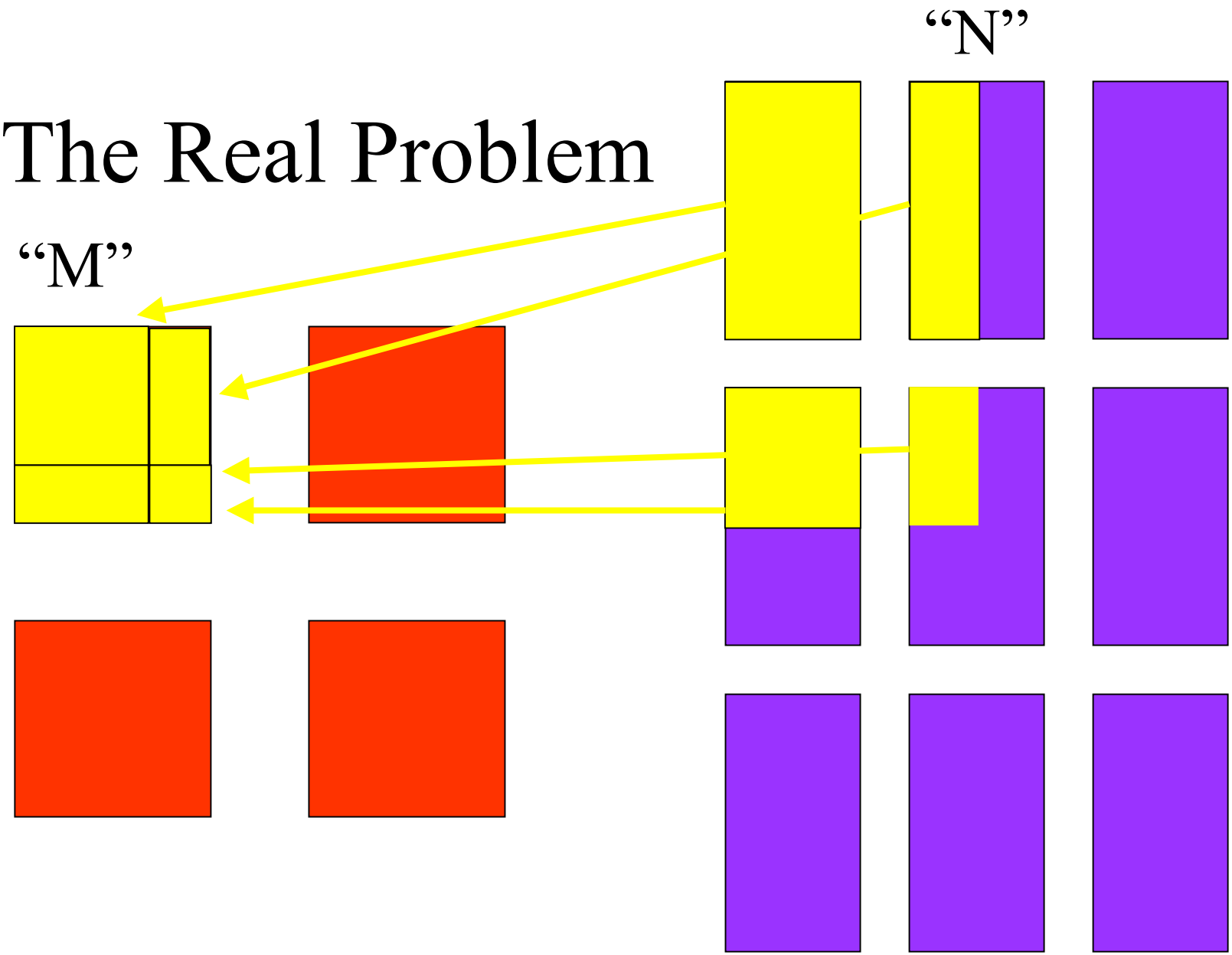
“M”



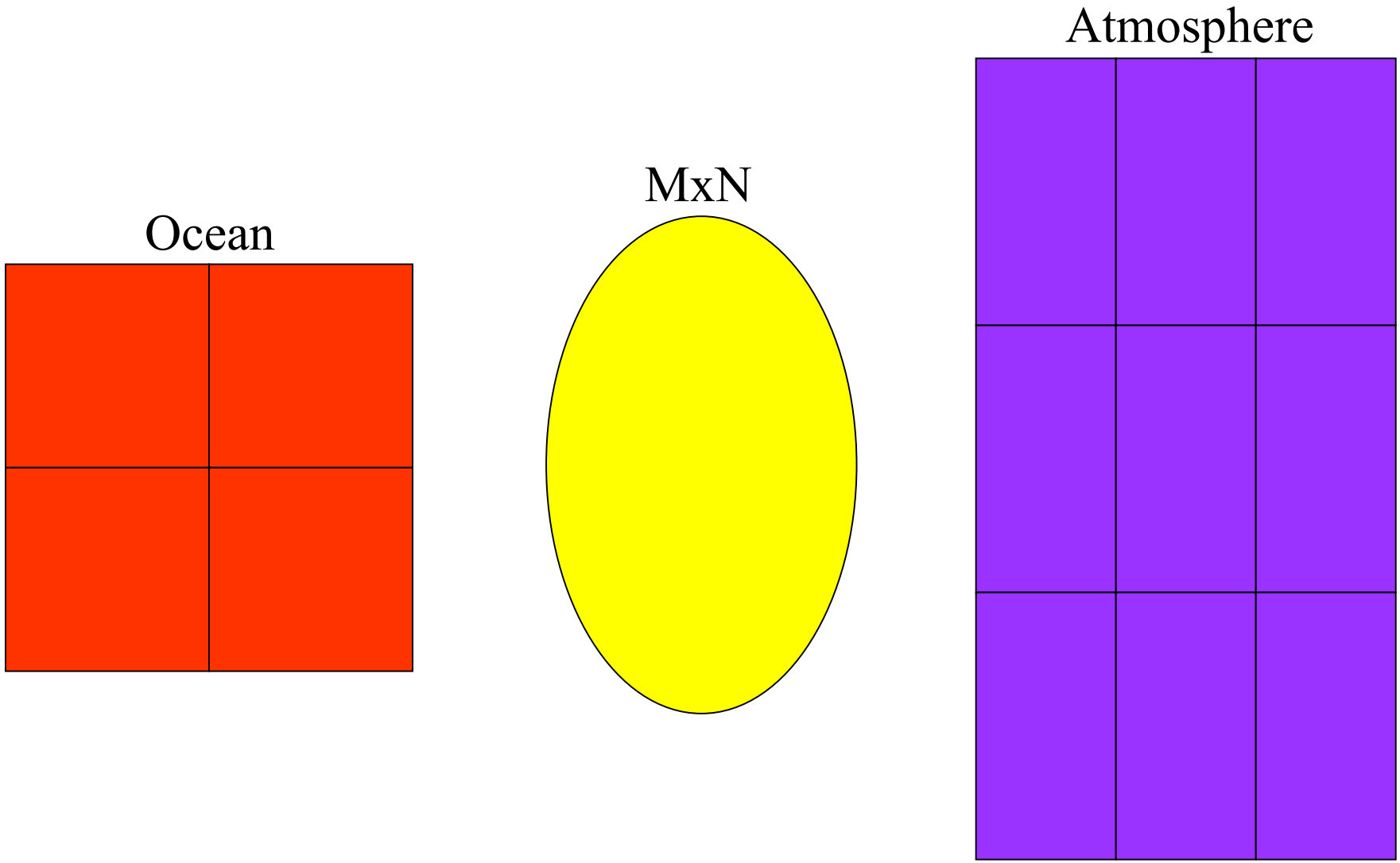
“N”



The Real Problem



MxN Component Example



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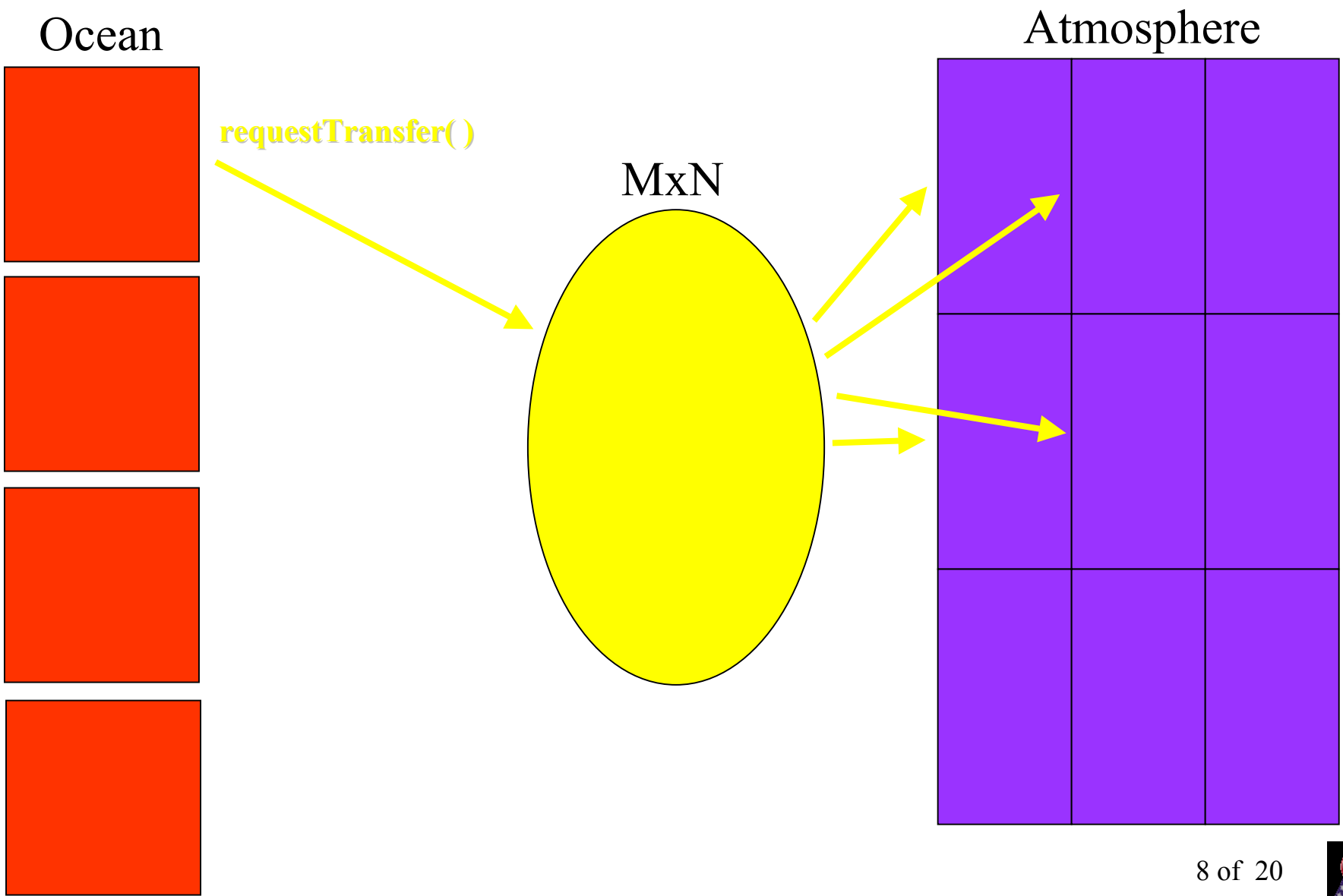

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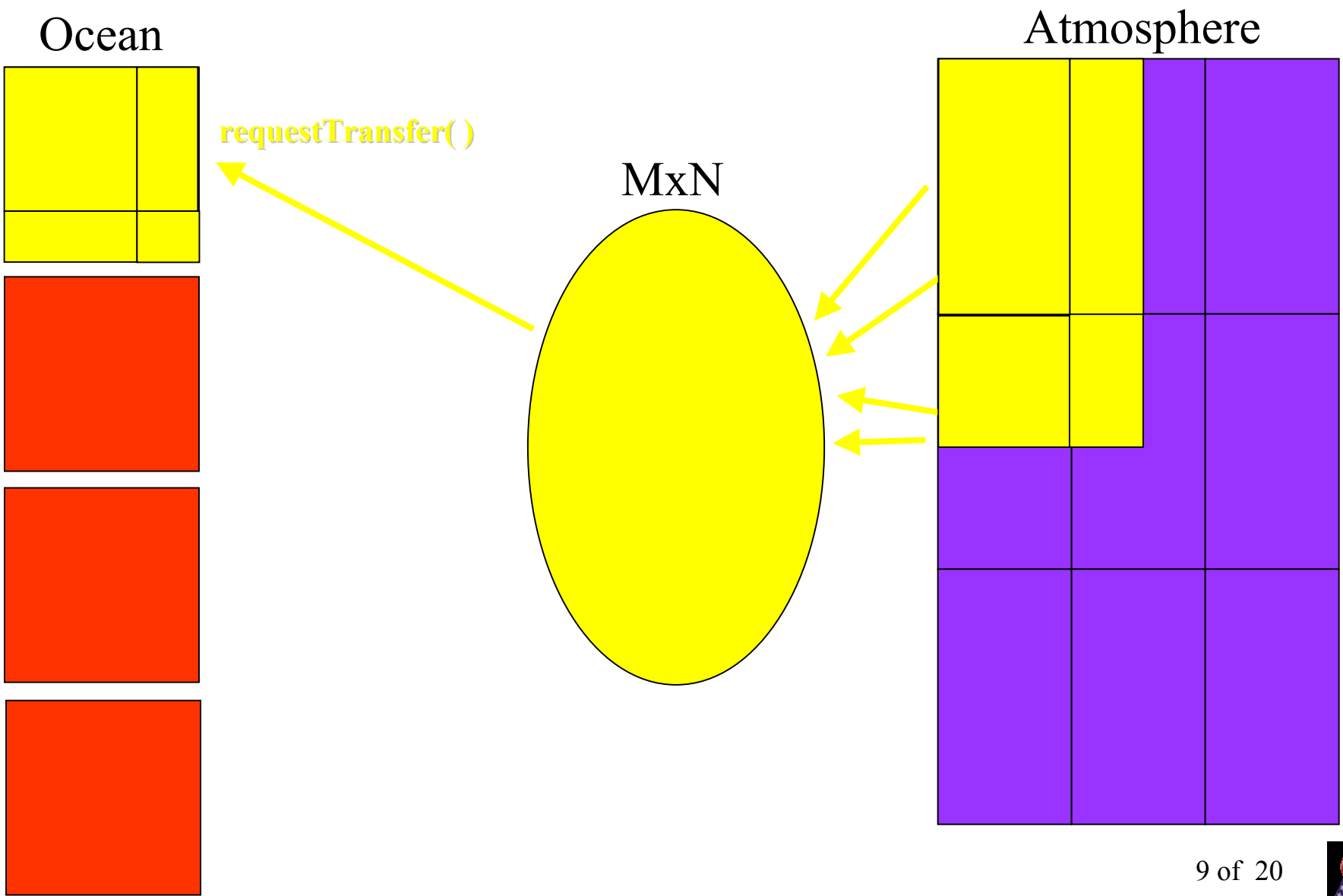
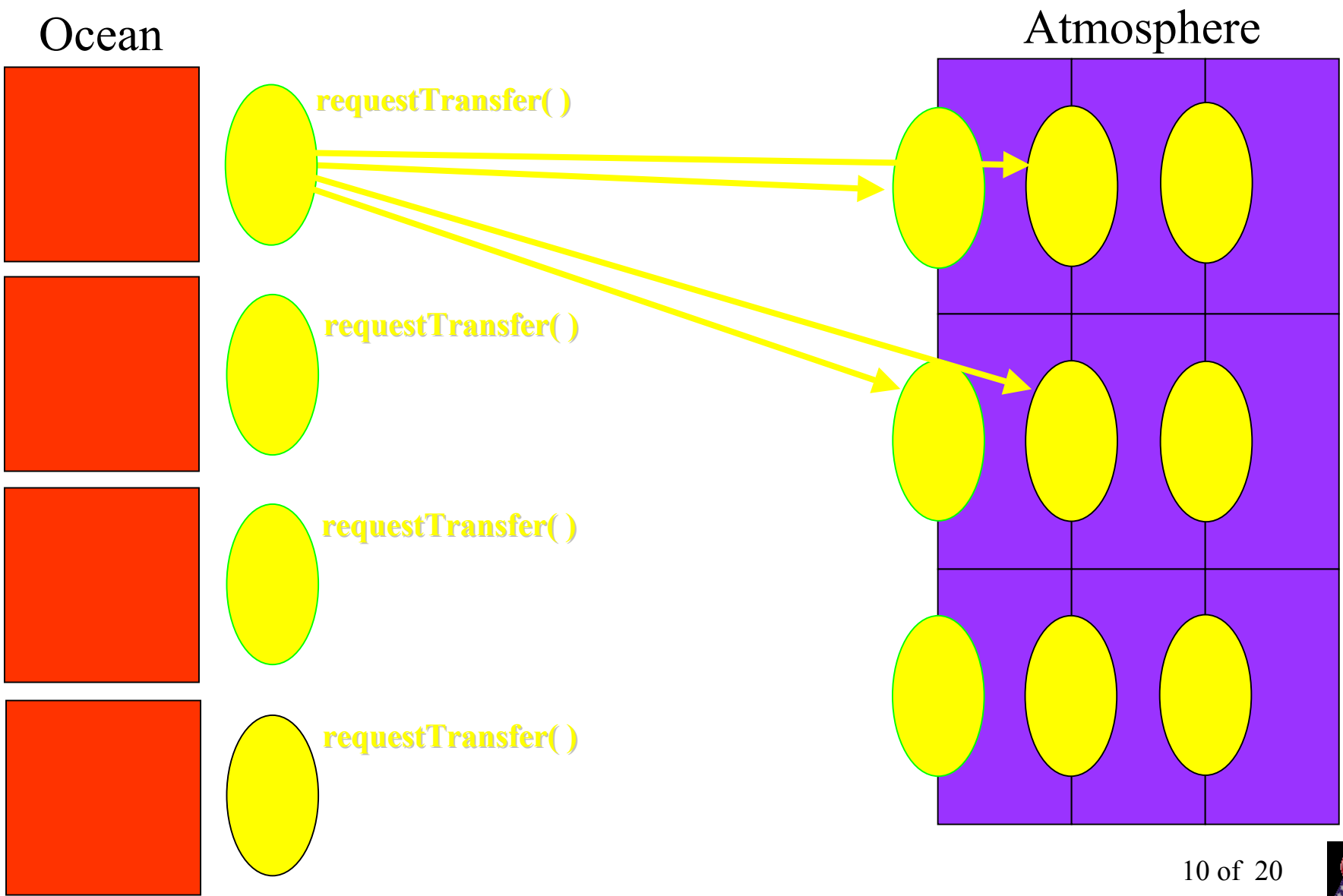


Scalable MxN Component Example



Overview of Current MxN Spec

- General & Flexible
  - ⇒ Legacy / Independent Components
  - ⇒ Direct or 3rd Party Control
- Several Functional Portions
  - ⇒ Data "Registration"
  - ⇒ Communication Schedules
  - ⇒ MxN Connections
  - ⇒ Data Transfers ~ **`dataReady()`**
- 1st Official MxN Working Group Meeting!
  - ⇒ Bishop's Lodge, Santa Fe, January 2002.

MxN "Spec Split"

- MxNDataPort.h
  - ⇒ Baseline Component Instrumentation
  - ⇒ Includes: **`registerData(), dataReady*()`**
- MxNCtrlPort.h
  - ⇒ MxN "Control" Port, for Endpoint or 3rd Party
  - ⇒ Comm Schedule, Connections, Transfers…
- MxNDataHandle.h
  - ⇒ Returned by **`registerData()`**
  - ⇒ Used Primarily by Control Port…

Extensions to dataReady( )…

- Access Mode
  - ⇒ **`ReadOnly`**, **`WriteOnly`**, **`ReadWrite`**
- New "**`flags`**" Argument
  - ⇒ Set Extensible Option Bits
    - **`dataReadyDefault`** ~ default "**`flags`**" value…
    - **`dataReadyNoTimeUpdate`** ~ multiple "ready"s…
    - **`dataReadyDataUnchanged`** ~ comm optimization…

SC01 Reconciliation

CUMULVS vs. PAWS Interpretations…

- Application Discovery
  - ⇒ **`getRegisteredData()`** vs. **`getAllRegisteredData()`**
  - ⇒ "Name Service" vs. **`partner()`** method…
- Base MxN Synchronization
  - ⇒ New **`synch()`** method
  - ⇒ Allows Lockstep Coupling from Initial Iteration
  - ⇒ Generally Handy… ☺ (startup race condition…)

Communication Schedules

- "Exposed" a Few Meetings Ago…
- Interface to Regenerate or Modify?
  - ⇒ Discussed at Length…
  - ⇒ All Boils Down to "Dup & Tweak" ☺
- New "**`extrapolateCommSched()`**" Method
  - ⇒ Copy & Modify (Update or Extend) Existing CS
  - ⇒ Pass in New Source / Dst Decomps
  - ⇒ Assumes Implementation Saves Old Decomps…

MxN Connection Modifications…

- Generally Not a Good Idea… ☺
- Change Connection Frequencies

  ⇒ New **`changeFreqs()`** Method

  - Existing MxN Connection Handle
  - Modify Frequencies of Transfer

    → At Source ("M" Side)

    → At Destination ("N" Side)

Note: MxN Spec Supports Disparate Frequencies at Source & Destination Side… Can Proceed at Different Rates…

MxN Data Handles

- Register / Unregister Data for Access
- Gather Information for Connection
- Sketch of Interface:
  - ⇒ **`getApplName()`**
  - ⇒ **`getDataName()`**
  - ⇒ **`getDADF()`**
    - Use to Get Data Bounds, etc…

MxN and MCT

- MCT ~ Model Coupling Toolkit
  - ⇒ Climate Modeling / Jay Larson (ANL)
  - ⇒ Climate-Specific Coupling Infrastructure
- All F90 Code
  - ⇒ Wrapping in SIDL to Create MCT CCA Ports…
  - ⇒ Ultimately Integrate with MxN
    - Matching Terminology & Constructs…
    - MxN using MCT Technology
    - MCT using Other MxN Components (e.g. CUMULVS)

Current MxN Status

- Draft MxN Interface Specification Progress
  - ⇒ Unifies Several Existing Approaches
    - CUMULVS & PAWS
- Successful SC01 MxN Component Demos
  - ⇒ "Sumo" Tar Ball Now Available! ☺
    - www.cca-forum.org/cca-sc01/
- Future Work:
  - ⇒ Fully Implement Spec… Interoperability…

Latest Spec: http://www.csm.ornl.gov/cca/mxn/