1 M

2 M

3 M

12 M

13 M

14 M

15 M

4 M

5 M

6 M

7 M

8 M

9 M

10 M

11 M

16 M

17 M

18 M

19 M

20 M

21 M

22 M

M 14

M 13

D 13

M 12

D 12

M 11

M 10

D 10

M 9

D 9

M 8

7

M 6

D 6

D 5

M 4

D 4

3

2

1

── *O(N2)* = NN / *O(N)* = N

── Data metric = M / Non-Metric =N

── Data metric = M / Non-Metric =N

── Model Abstraction

── Data Abstraction

── Iterative/Simple

── Regular = R / Irregular = I Model

── Regular = R / Irregular = I Data

── Dynamic = D / Static = S

── Dynamic = D / Static = S

── Communication Structure

── Veracity

── Model Variety

── Data Variety

── Data Velocity

── Model Size

── Data Volume

── Execution Environment/Core Libraries

── Flops per Byte/Memory IO/Flops per watt

── Performance Metrics

Micro-benchmarks ──

Local (Analytics/Informatics/Simulations) ──

Global (Analytics/Informatics/Simulations) ──

Linear Algebra Kernels/Many Subclasses ──

Graph Algorithms ──

Visualization ──

Core Libraries ──

Base Data Statistics ──

Recommender Engine ──

Data Search/Query/Index ──

Data Classification ──

Learning ──

Optimization Methodology ──

Streaming Data Algorithms ──

Data Alignment ──

Iterative PDE Solvers ──

Multiscale Method ──

Spectral Methods ──

N-body Methods ──

Particles and Fields ──

Evolution of Discrete Systems ──

Nature of Mesh (if used) ──

── Geospatial Information System

── HPC Simulations

── Internet of Things

── Metadata/Provenance

── Shared/Dedicated/Transient/Permanent

── Archived/Batched/Streaming – S1, S2, S3, S4, S5

── HDFS/Lustre/GPFS

── Files/Objects

── Enterprise Data Model

── SQL/NoSQL/NewSQL

10 9 8 7 6 5 4 3 2 1

D D D D D D D D D

── Workflow

── Agents

── Dataflow

── Fusion

── Bulk Synchronous Parallel

── Single Program Multiple Data

── Shared Memory

── Map Streaming

── Map Point-to-Point

── Map-Collective

── Classic MapReduce

── Pleasingly Parallel

M

1 2 3 4 5 6 7 8 9 10 11 12

**Convergence Diamonds Views and Facets**

**Problem Architecture View**

**Processing View**

**Execution View**

**Data Source and Style View**

Big Data Processing Diamonds

Simulation (Exascale) Processing Diamonds

