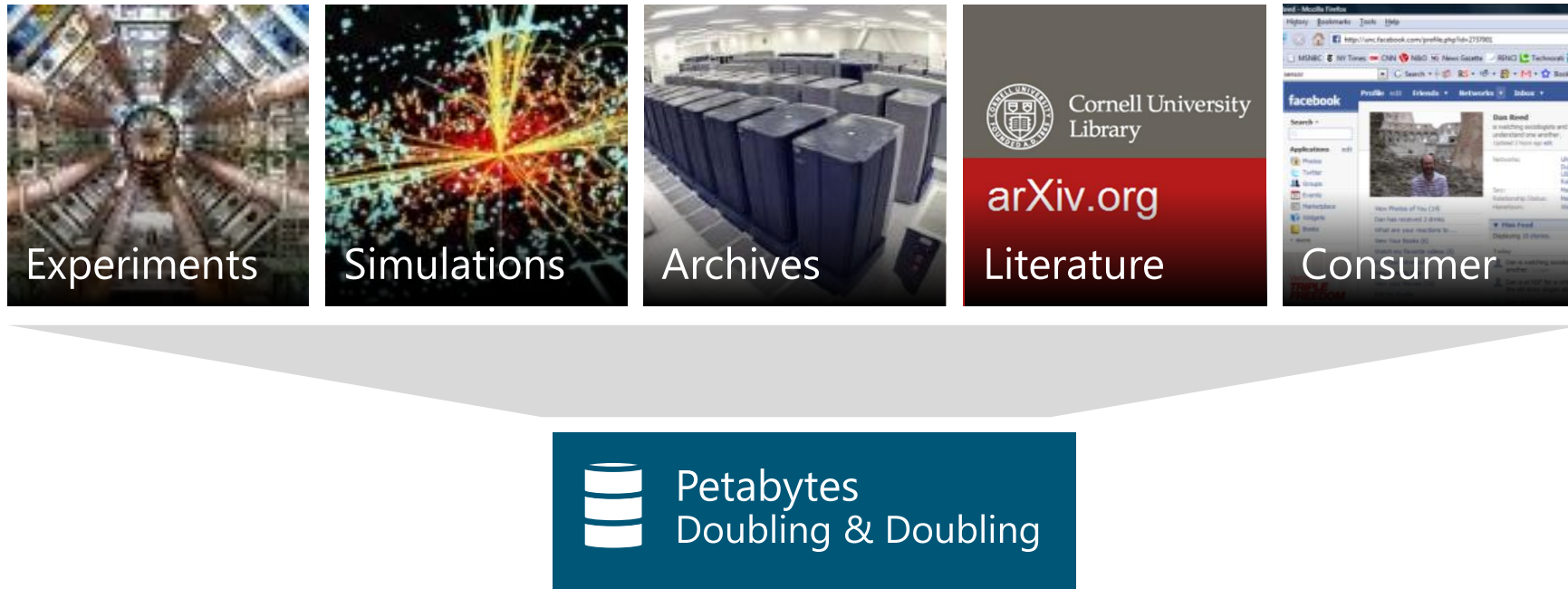


# Big data: Creating economically sustainable research data services

Dr. Daniel Reed | Technology Policy Group

# The fourth paradigm: data and research transformation



Every area of science and engineering is now engaged in data intensive research

- It is not just "big" science and instruments – it is the long tail as well

Researchers, governments and society need

- Technology to publish and share data, within and across disciplines and organizations
- Simple, intuitive data analytics services & tools to explore massive data collections
- A **sustainable economic and cultural marketplace** for analysis, collaboration and data curation
  - Creation is the inexpensive element (the iceberg phenomenon)

# Let scientists be scientists... in a data rich world

## Few scientists want to become computing system experts

- Yet many spend large fractions of their time managing computing infrastructure
- Sustaining data are often not their interests, especially if other disciplines/entities are the beneficiaries

## They want to focus on their science and engineering

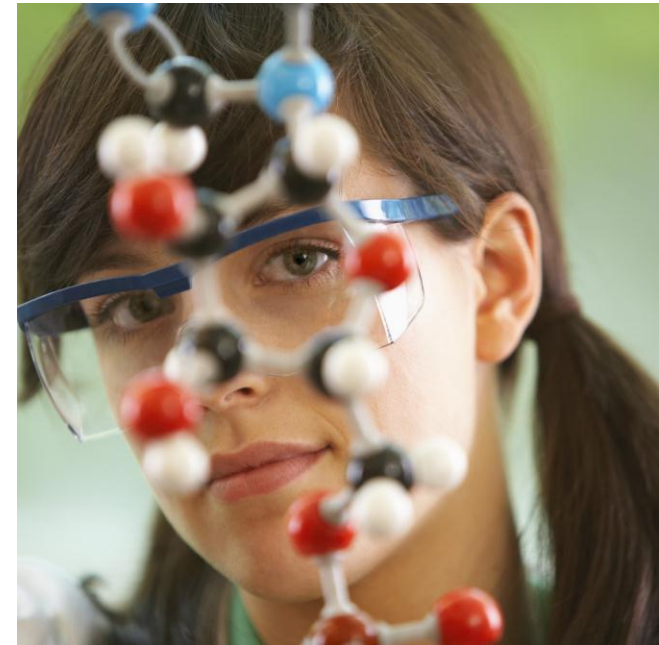
- This is why they became scientists and engineers

## Successful and sustainable technologies become invisible

- Their learning curves are small, with broad use
- They empower without burdening
- They are economically and culturally sustainable
- They build on real, not hypothetical experience, and evolve accordingly

*I want to build tools so powerful that full professors will use them, and so simple that they can.*

Fred Brooks (rough paraphrase)



# A new model for data intensive scientific sustainability

Cloud data services and easy-to-use client tools can open the door for a new research and innovation paradigm

A research data services cloud, with a layered ecosystem

- Public/private partnerships
- Open and extensible
- Easily accessed by simple desktop/web analysis applications
- Encourages scientific, engineering and business collaborations

An ecosystem that supports a **marketplace** of research tools and domain expertise

- Providing an economic sustainability model for data preservation and use
- Allowing researchers to outsource special tasks to expert service providers



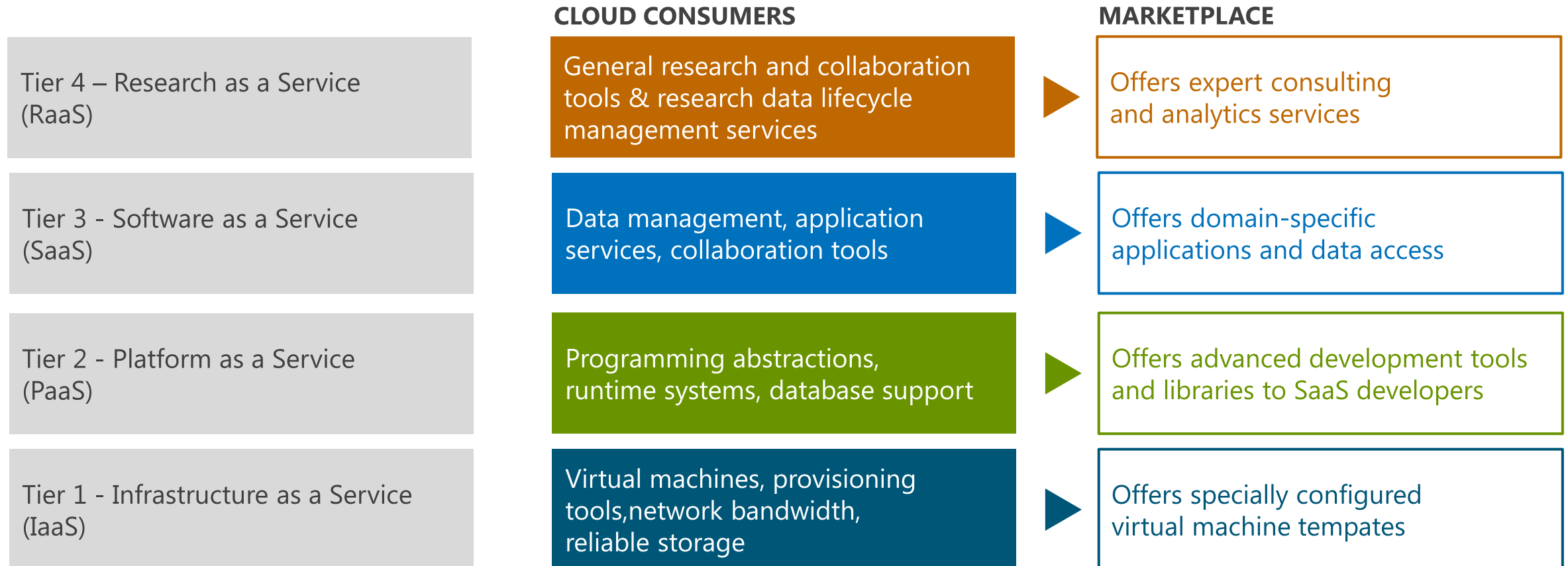
# Research and data as a service (RaaS)

## Scientific data analysis services: a marketplace of data and application services

- Offer research data services across communities and the potential for data services to commercial participants

## A greater opportunity for the science community: a marketplace of expert research services

- Provide consulting/expert services directly to other researchers and third party customers



# Research and data as a service: key characteristics



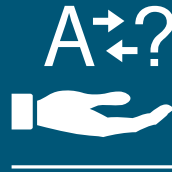
## Marketplace

Marketplace of services offered by researchers to other researchers



## Services + storage

Services offered alongside/powered by highly scalable storage & compute infrastructure



## 'Long-tail' research client tools

Simple client tools with rich features, accelerated and extended into the cloud, with expert services atop



## Revenue streams

Other revenue streams can contribute to long-term data archiving and data curation costs

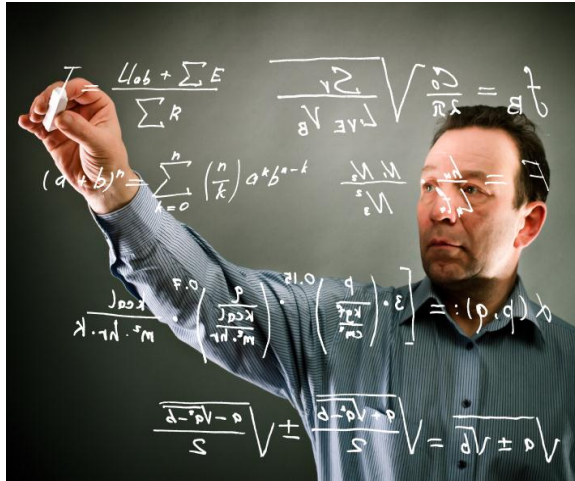


## Integrated platform

An integrated platform for scientific & commercial innovation



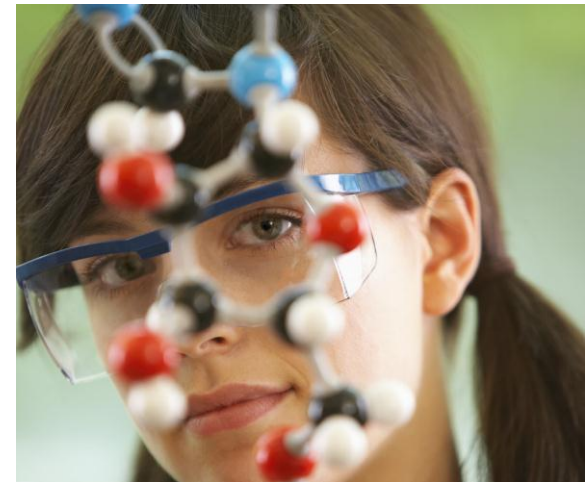
# A revolution in scientific data management and discovery



As individuals, we have access to more computing power than the fastest supercomputers once provided to a select few

Collectively, we have moved from a world of scientific data scarcity to data plethora

When combined with cloud services and easy-to-use client tools, new kinds of innovation experiences can emerge, if we create the right **economic, technical and cultural models**



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