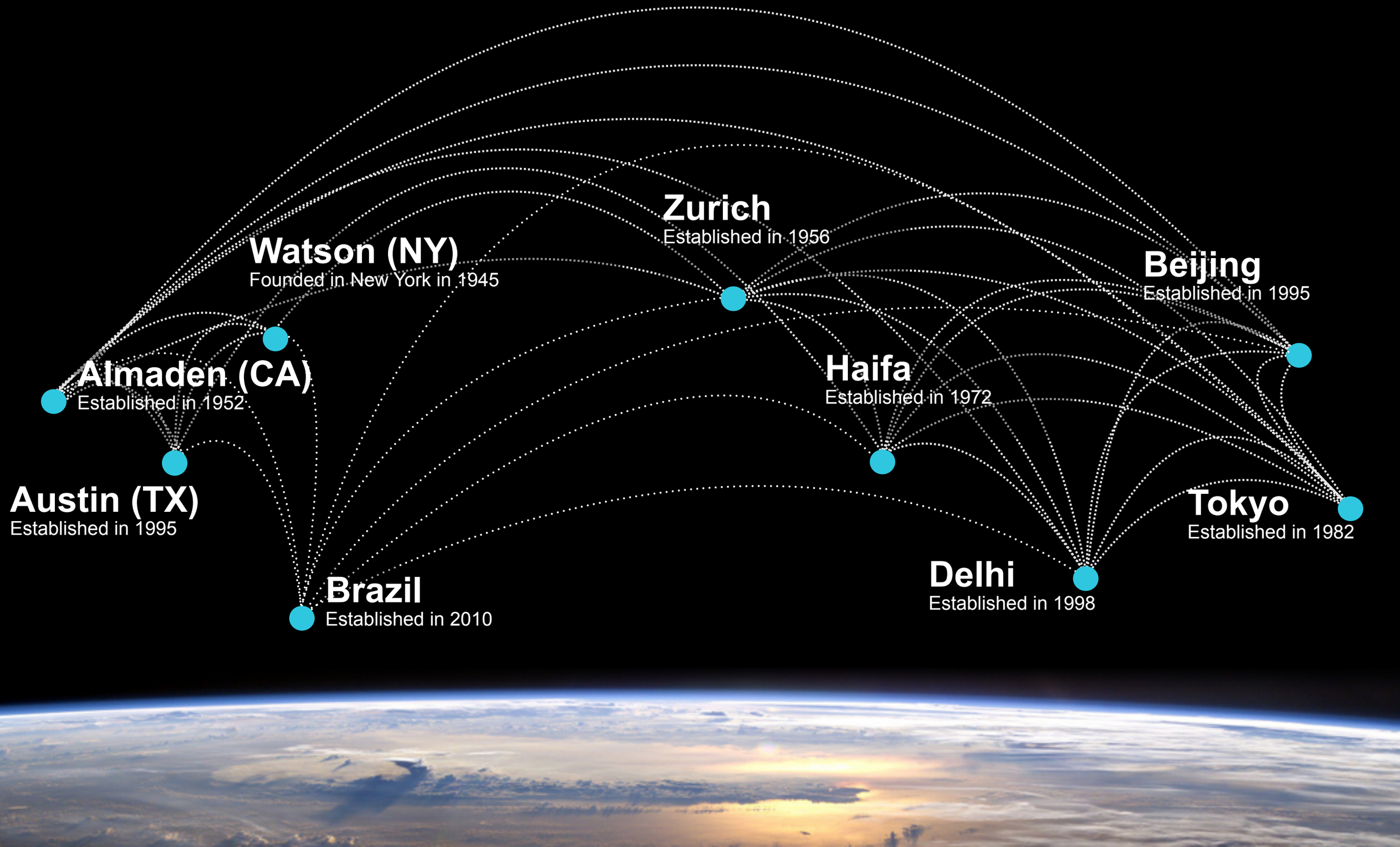
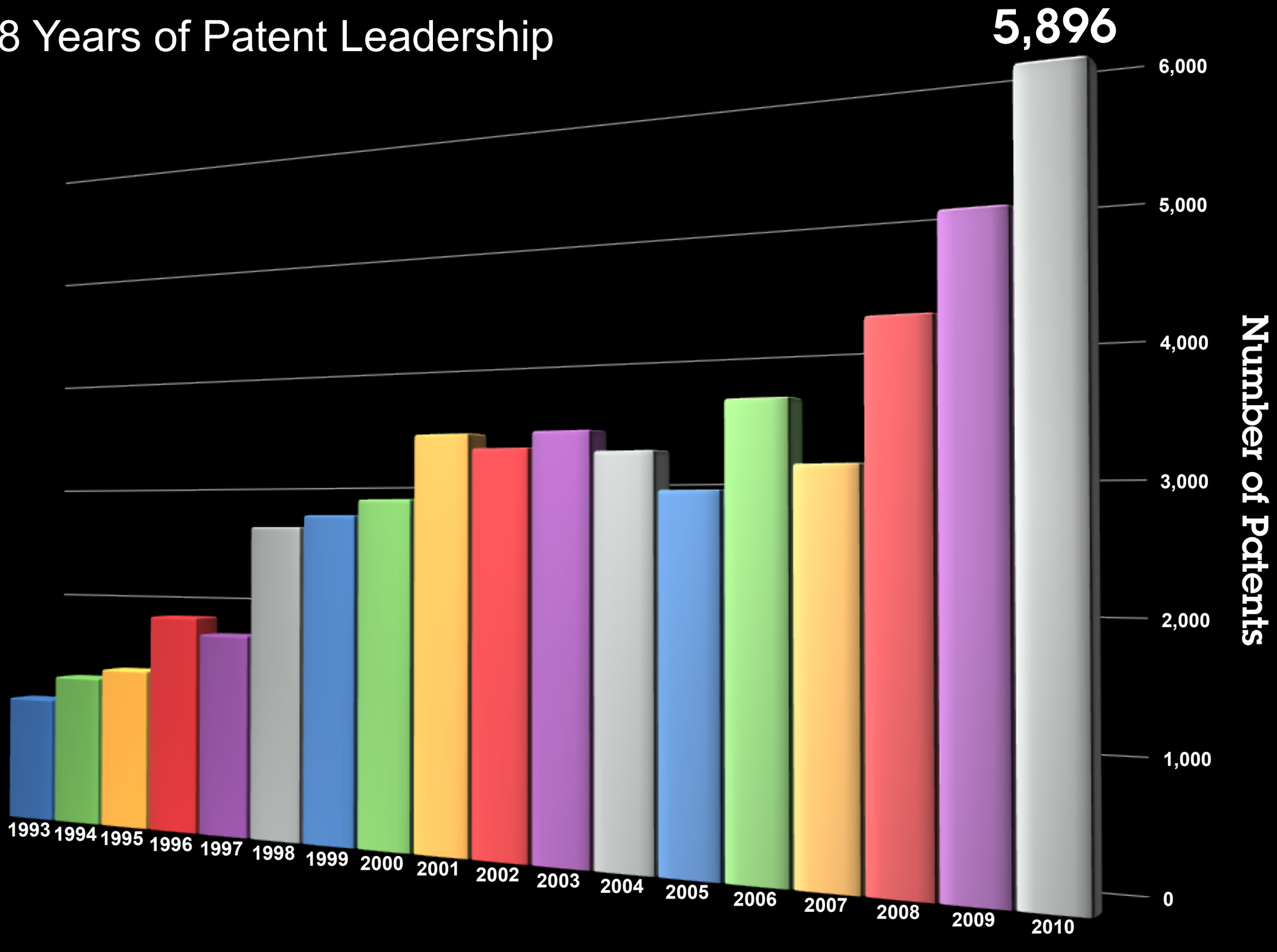
IT Technologies for the Future

Dr. Matthias Kaiserswerth
Vice President & Director
IBM Research - Zurich

IBM Research: Globally Integrated



18 Years of Patent Leadership



Creating innovative industry and client oriented solutions in the IT industry have been achieved by

Continual Improvement & Disruptive Innovation

Four Technologies that Will Change Industries and the World

Compute+ Natural Language+ Analytics

Deep Q&A Computers

Program → Learn

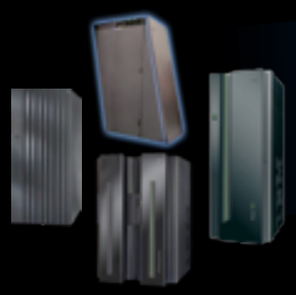
Cognitive Computing
- "Synapse" devices

Big Data

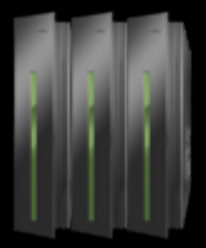
1,000 → 1,000,000 X
Smarter Planet
(Internet of Things + People)

BIG/*Fast*
- Data + analytics (zettabytes + milli / microseconds

Workload Optimized Systems



1000X



Exascale
(Datacenter-in-a-box)
- Massive parallelism
- Flexible system optimization

Nano Devices

1B Transistors

Power7 chip

1000X

1T Devices

Nano Systems
(Systems-on-a-chip)
- Photonics
- DNA Transistor

From Nano Devices to Nano Systems

Compute+ Natural Language+ Analytics

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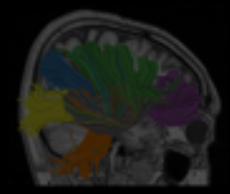

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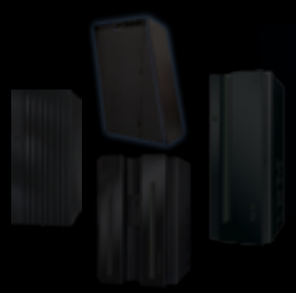

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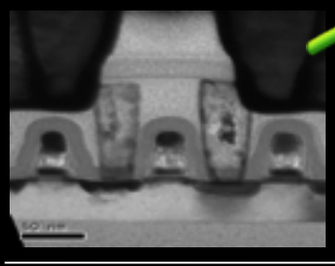
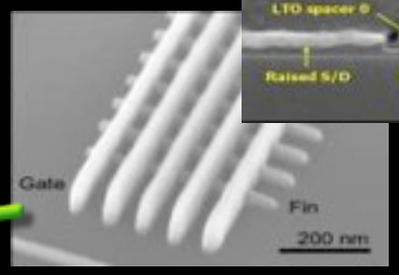
Device Structure Research Pipeline

Innovation and Disruptive Technology at Each Node

Conventional Planar Device

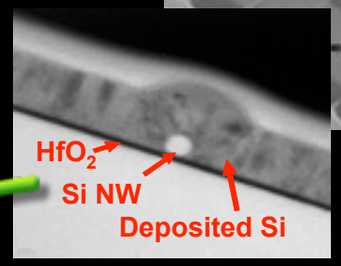


FINFET



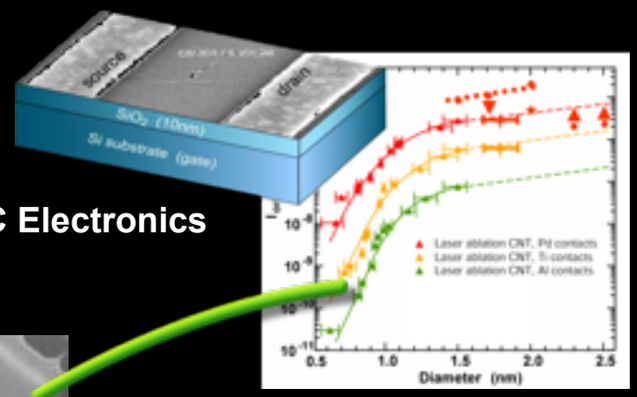
ETSOI

Fully Depleted Devices



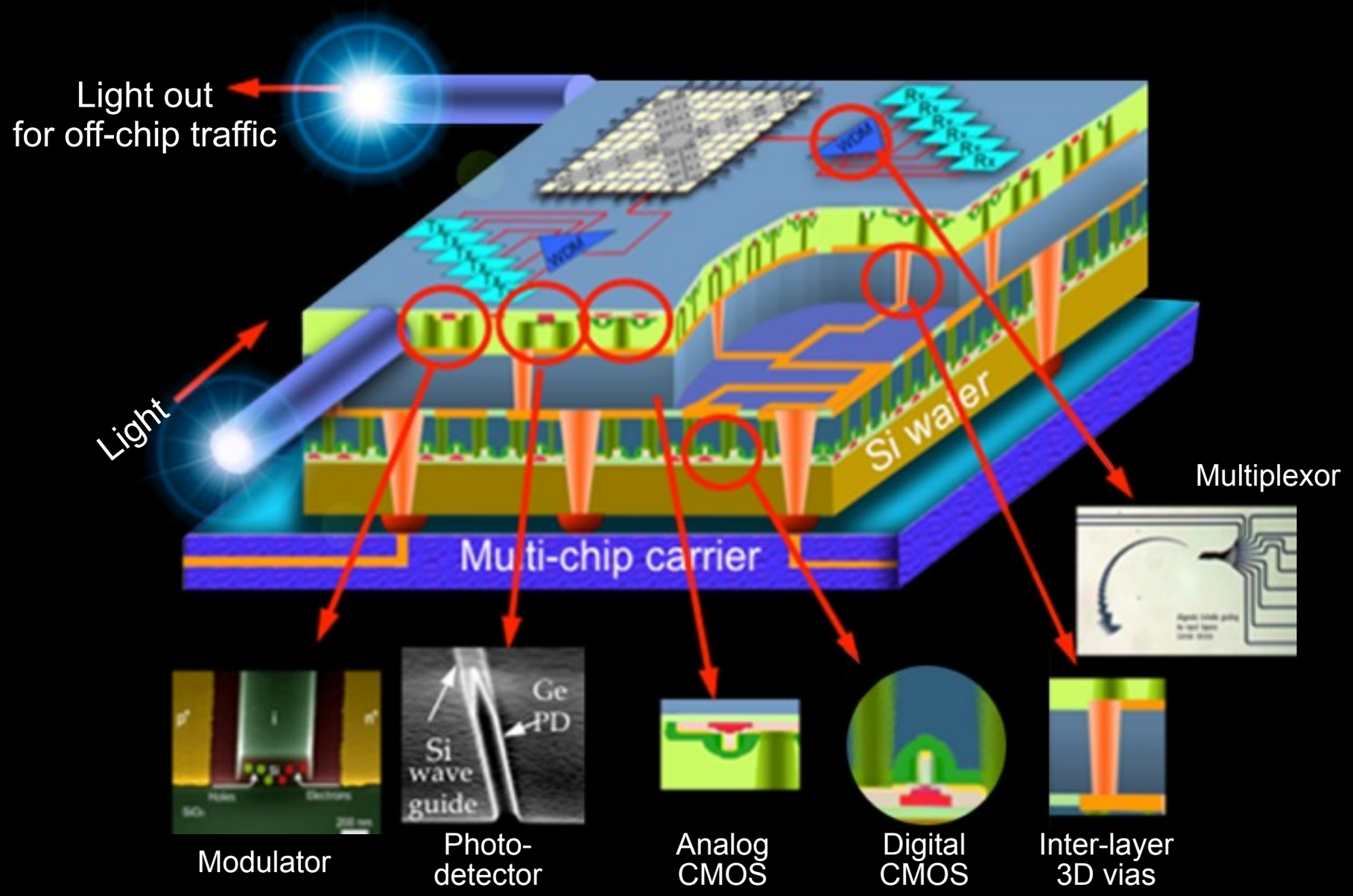
Si Nano-Wire

C Electronics



22/20 nm | **15/11 nm** | **8 nm & Beyond**

Vision: >1 Tbps on a 3D chip



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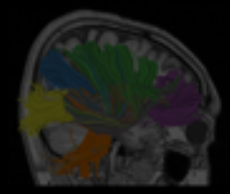

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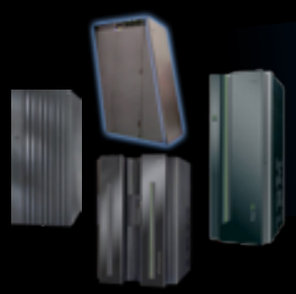

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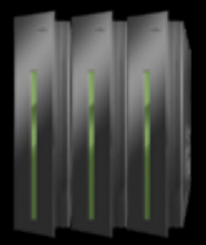

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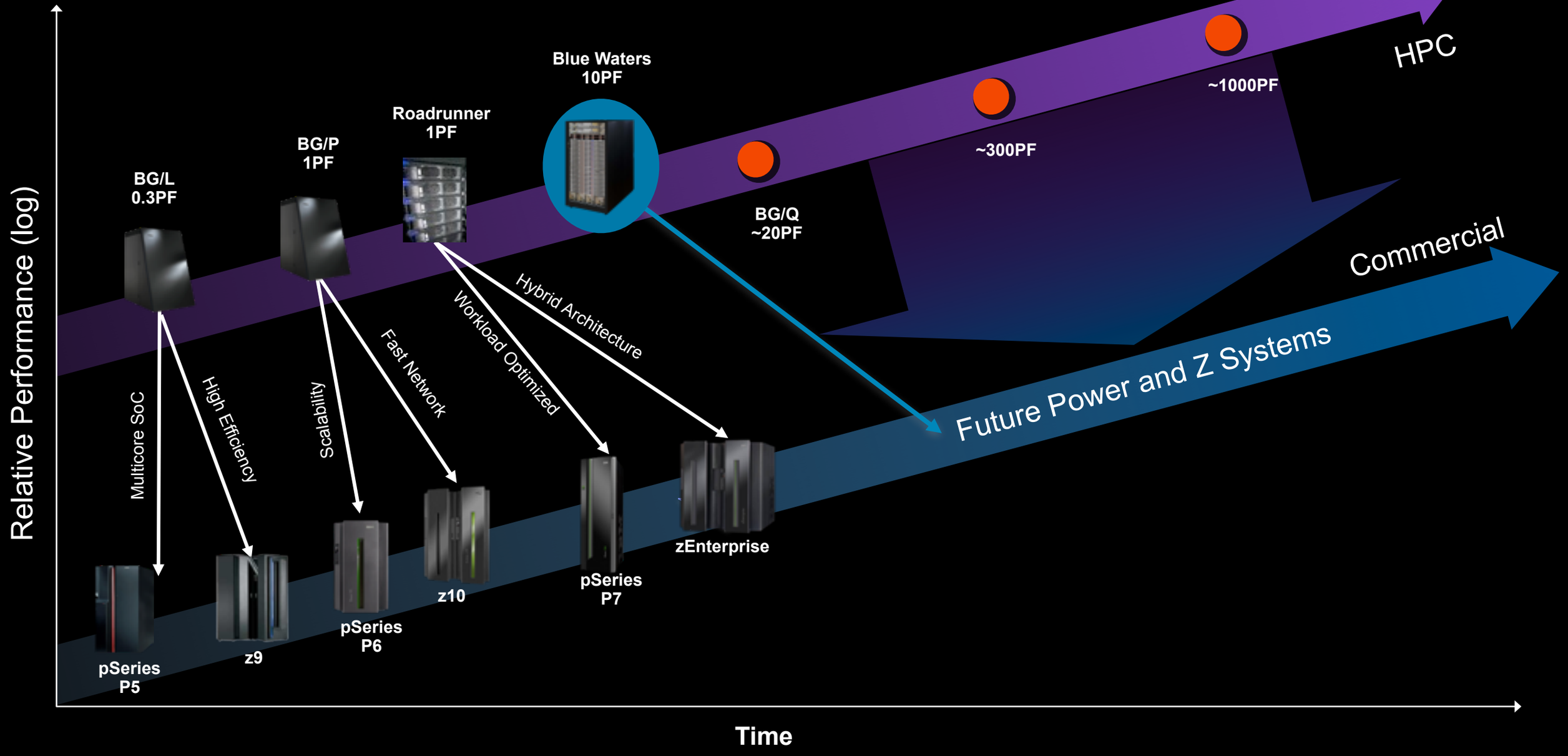
From Disruptive Technologies in HPC to Transfer to Commercial Leadership



From Silicon to Structure: A Holistic Approach

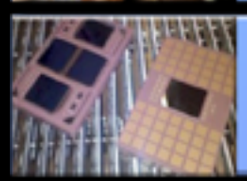

Modern Data Center

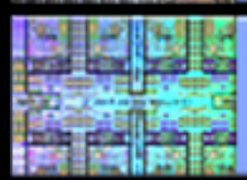

Machine Room Gallery


Machine Room Subfloor


Rack


Drawer


MCM


Processor

The Charge to Exascale: Future Technologies

Overall Performance = 1000X
Performance / watt = 135X
Performance / $ = 1000X
Footprint = <2%
Referenced to1PF system

1 PetaFlop
72 BG/P Racks

CPU

Phase Change Memory

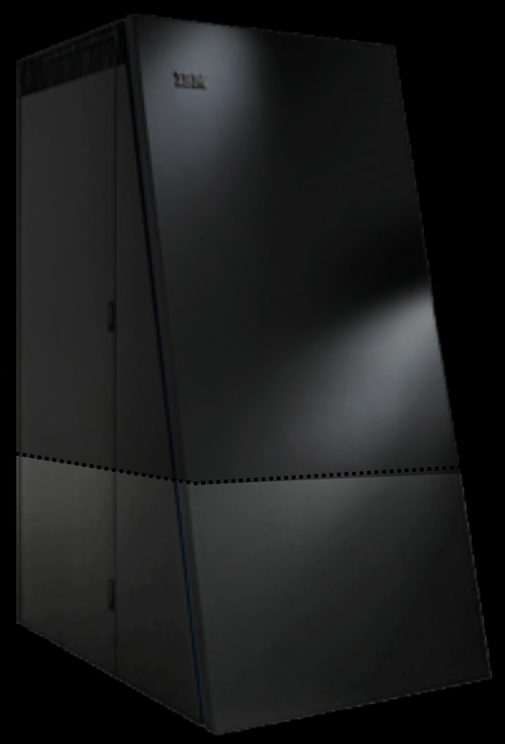
Silicon Photonics

Software

3D

The Next Ten Years

10 PetaFlop
100 P7IH Racks



1 PetaFlop = 1/3 rack

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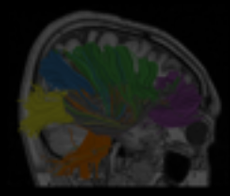

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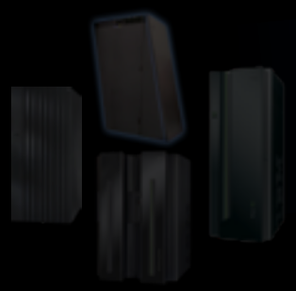

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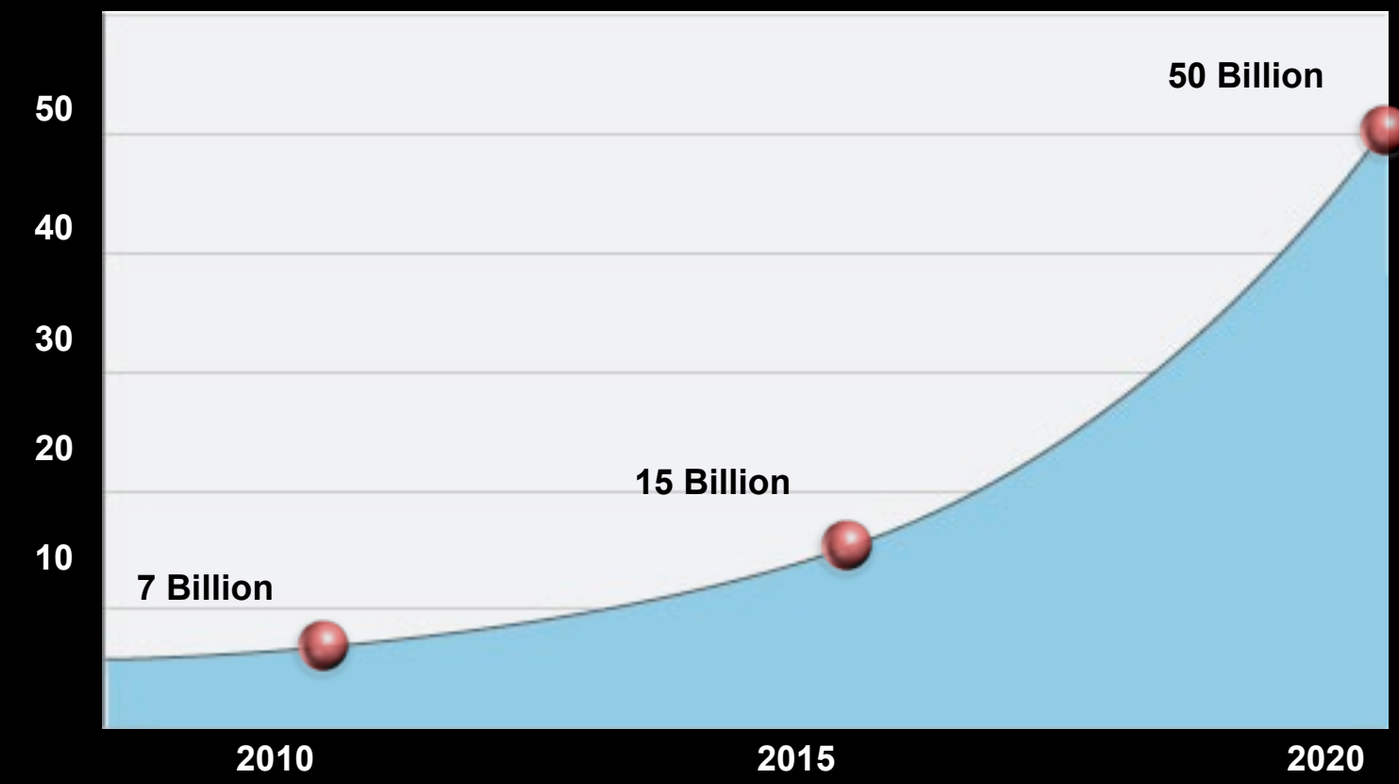
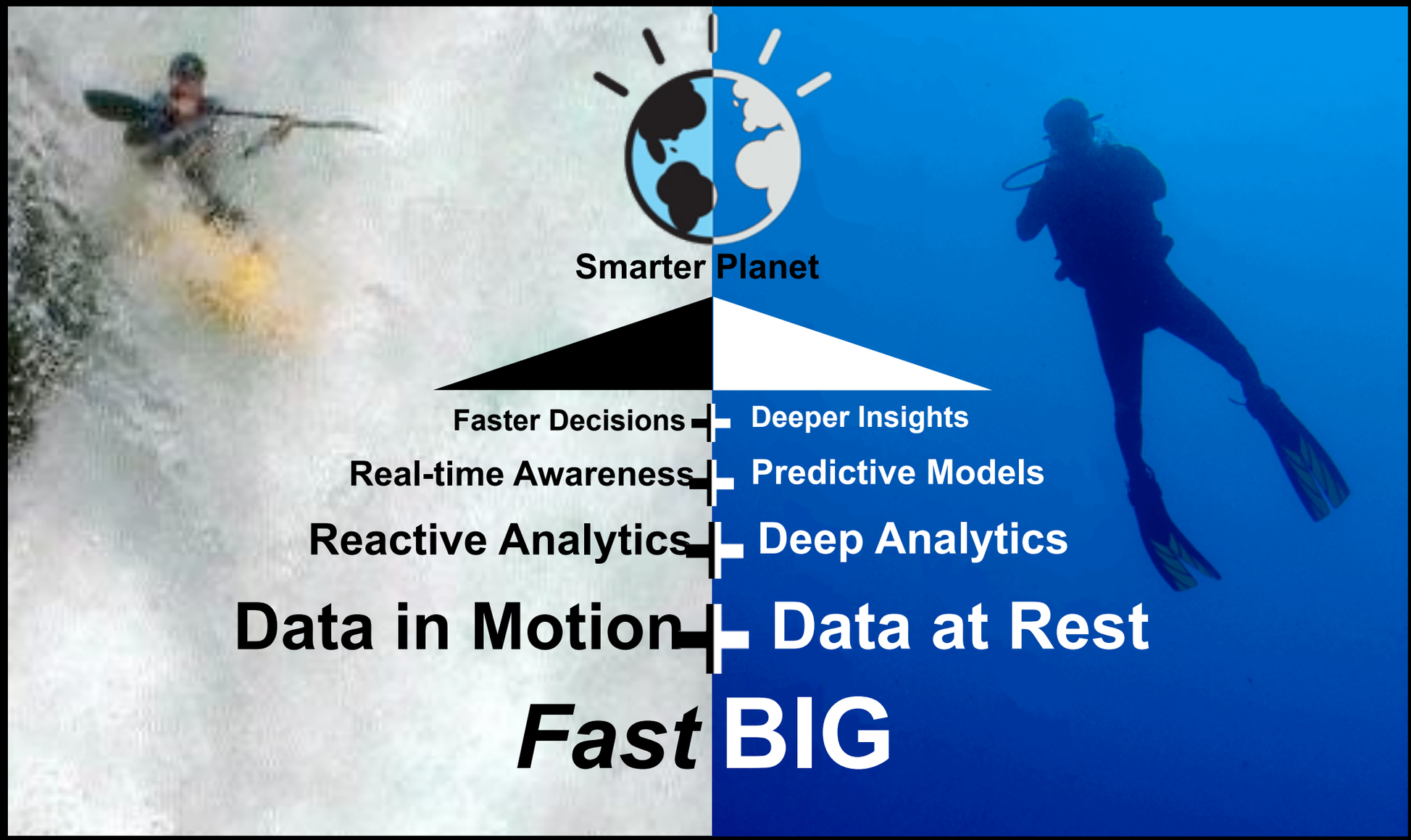
Smarter Planet will Drive the Creation of **Big**/*Fast* Data

Number of Connected Devices

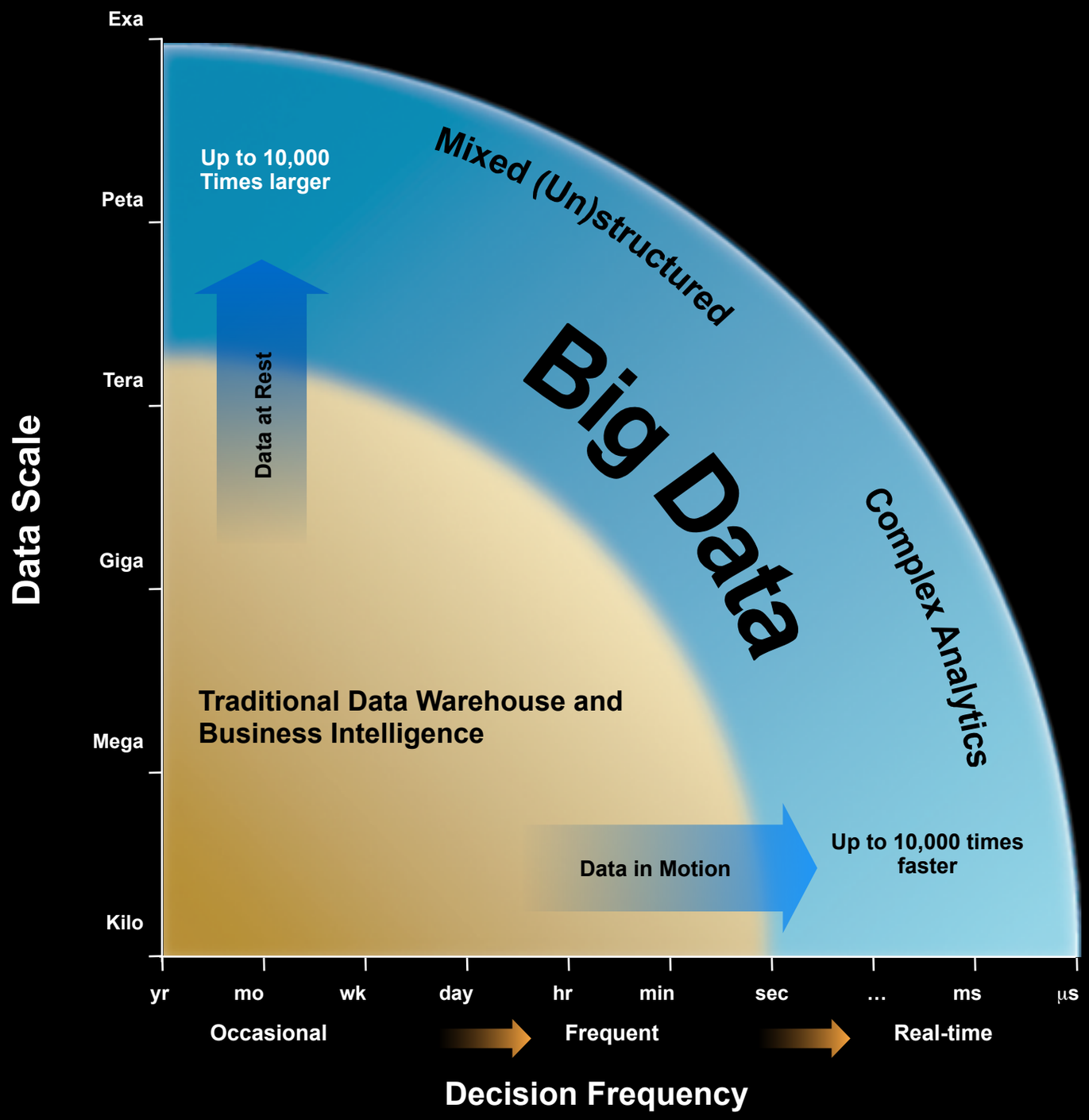


Multiple Sources: Intel, Ericsson, Gartner, etc.

Every Smarter Planet Solution Has **Big/***Fast* Data and Needs **Big/***Fast* Analytics



New **Big**/*Fast* Data Brings New Opportunities, Requires New Analytics



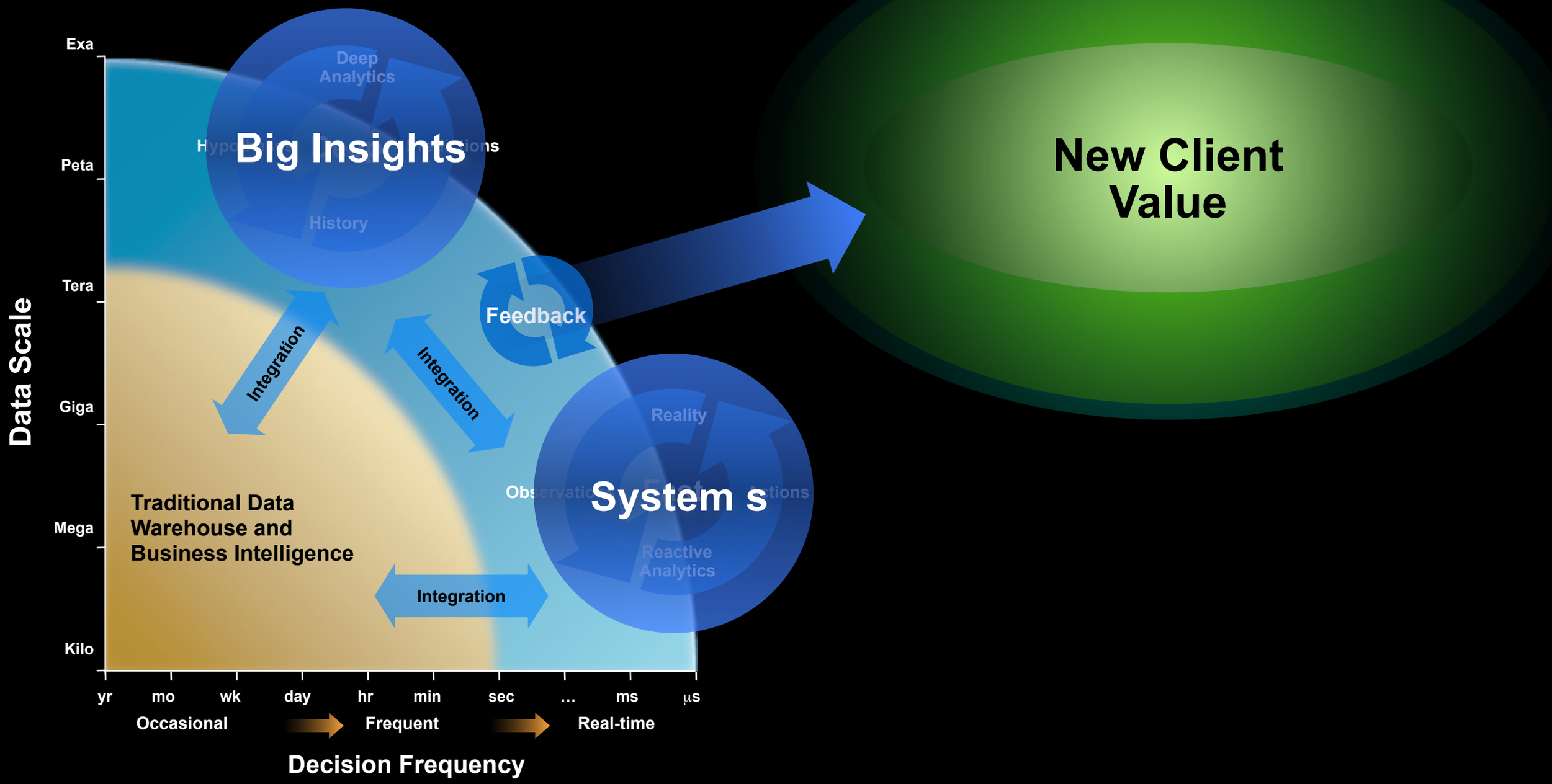
Homeland Security
600,000 records/sec, 50B/day
1-2 ms/decision
320TB for Deep Analytics

Telco Promotions
100,000 records/sec, 6B/day
10 ms/decision
270TB for Deep Analytics

DeepQA
100s GB for Deep Analytics
3 sec/decision

Smart Traffic
250K GPS probes/sec
630K segments/sec
2 ms/decision, 4K vehicles

Maximum Insight Requires Combining Deep and Reactive Analytics



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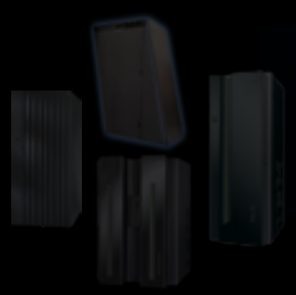

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What is Watson?

Decomposition

Hypothesis Generation

Hypothesis & Evidence Scoring

Question & Topic Analysis

Synthesis

Final Confidence Merging & Ranking

Text Search

Frame Induction | *Concept Matching* | Sequence Matching | Graph Matching | Frame Matching

Deep Parsing | *Entity Extraction* | Relation Extraction | Topic Detection | Sentence Decomposition

Structured Search

many others...

Statistical and Rule-based Analysis

Statistical Learning Framework
(Statistically combines disparate scores from many analytics based on Machine Learning)

UIMA for Text Analytics Standard Interoperability

UIMA-AS (Standard Messaging) for Scale-out and Speed

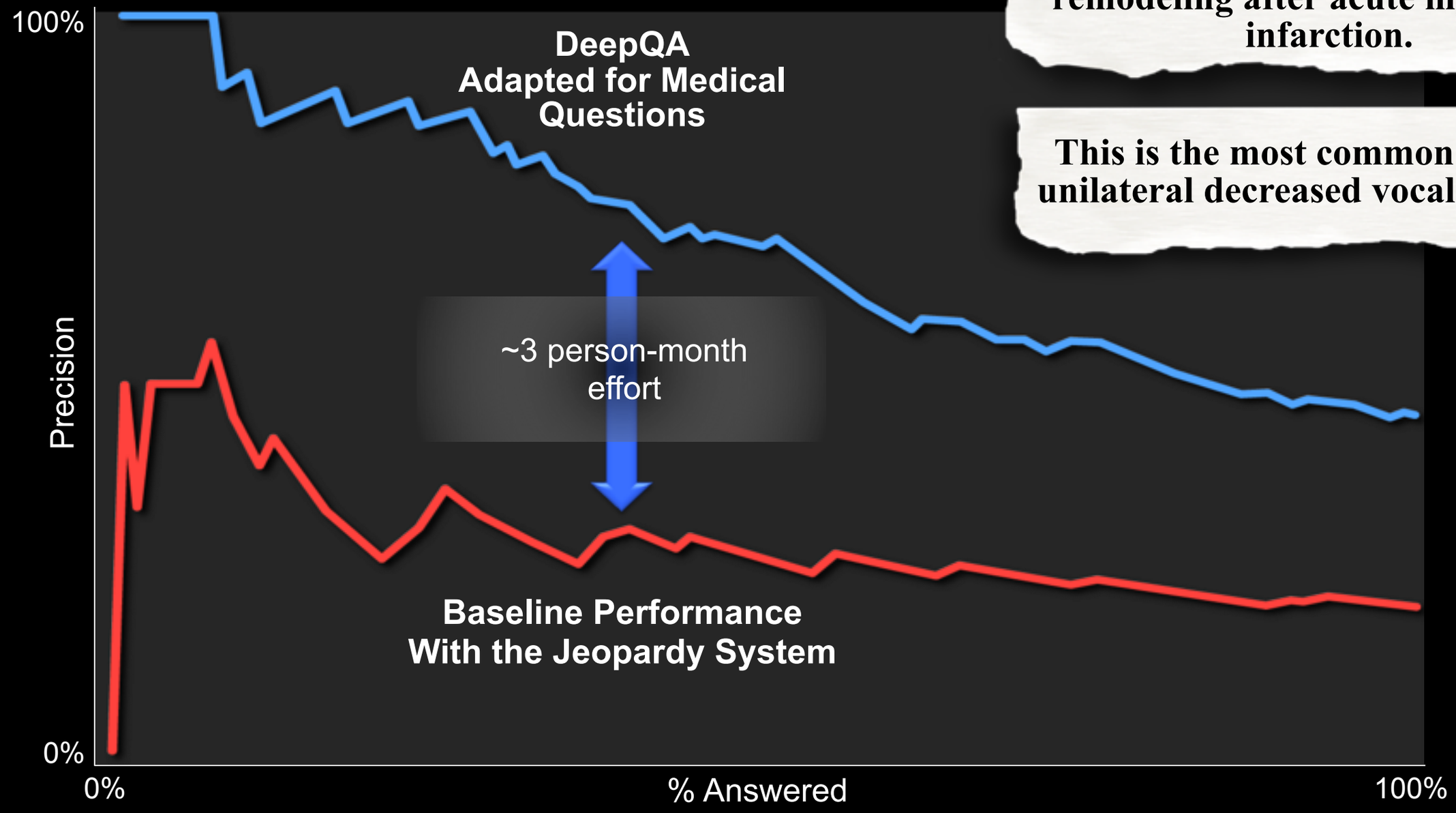
Linux

Power7

Workload Optimized

How we see Watson

From Trivia to Medicine



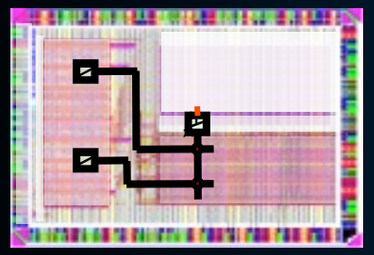
This is the selective aldosterone blocker that limits ventricular remodeling after acute myocardial infarction.

This is the most common cause of unilateral decreased vocal fremitus.

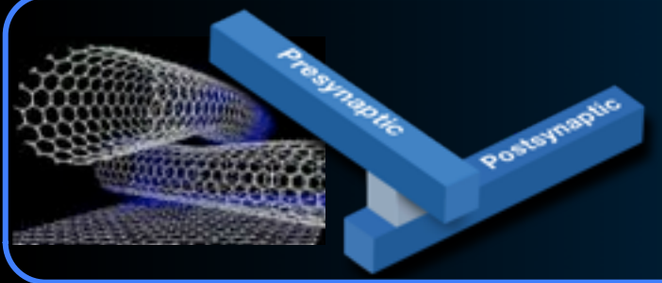
New Computing Architecture for Learning Systems

New Architecture

New Interconnect



New Chips



New Switch

We Are Entering a New Era

Smart Systems Era

Computing Era

Tabulating Era

Computer Intelligence

Time