IDF2013
英特尔信息技术峰会

超越 Hadoop* 的大数据： 未来的研究方向

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ACAS002

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议程

- 大数据和 Hadoop* 生态系统
- 英特尔与大学合作大数据研究
- 高效的 map reduce 内存实施
- 高效的图形分析算法
- 英特尔努力推动生产研究

本课程演示文稿（PDF）发布在技术课程目录网站:
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该网址同时打印于会议指南中专题讲座日程页的上方

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什么是大数据?

大数据的特点是数量大、速度快、现有系统与算法难以处理。

- 数量大
  - TB 级转向 PB 级
  - 需要智能(而非强力)的大规模并行处理
- 速度快
  - 无所不在的传感器带来了新的海量数据
  - 摄取困难
- 处理难
  - 需要复杂分析(例如，查找类型、趋势和关系)
  - 需要整合多种数据类型 (无模式，无管理，不一致的句法和语义)

数据应当是**资源**，而非负载
现有数据处理工具不够完善

例如： Web 分析

大型网络企业：

成千上万的服务器，

不计其数的用户，和

每天 TB 级的“键击资料”

不仅仅是简单的报告：

例如：实时分析用户的下一步操作，或

应该为他们提供什么广告，或

他们可以归于哪一用户类型

现有分析系统要么：

无法扩展至所需规模，要么

无法提供所需完善度

例如： 传感器分析

智能手机提供商

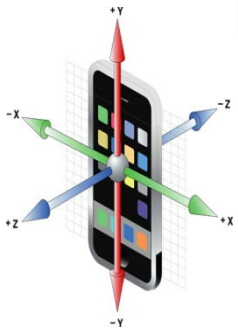
收费机构

市政部门

保险公司

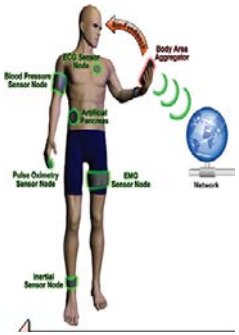
医生

企业



采集大规模视频流，定位，加速，
以及来自手机和其它设备的数据

这些数据需要存储、处理并挖掘，
例如，评测交通量、驾驶风险或医疗诊断。



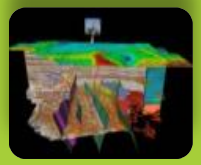
大数据生态系统中的 Hadoop*

经济高效的垂直解决方案


电子商务


医疗


制造


能源 - 科学


FSI

传统业务解决方案

业务流程创新

内存数据库 — 集成式分析 — 系统与设备

TERADATA

Informix

ORACLE 11g DATABASE

IBM DB2

Microsoft SQL Server 2008 R2

SAP HANA

大数据

Cassandra

hadoop

aster data
more data. big insights.

新分析模式

Spark
Lightning-Fast Cluster Computing

Twitter Storm

ORACLE EXALYTICS

Greenplum

SAS

VERTICA

Microsoft

计算平台技术

intel Atom inside

intel Xeon inside EP

intel inside Xeon EX

MIC

intel FULCRUM

结构

传统业务解决方案结合新分析模式实现实时价值机遇

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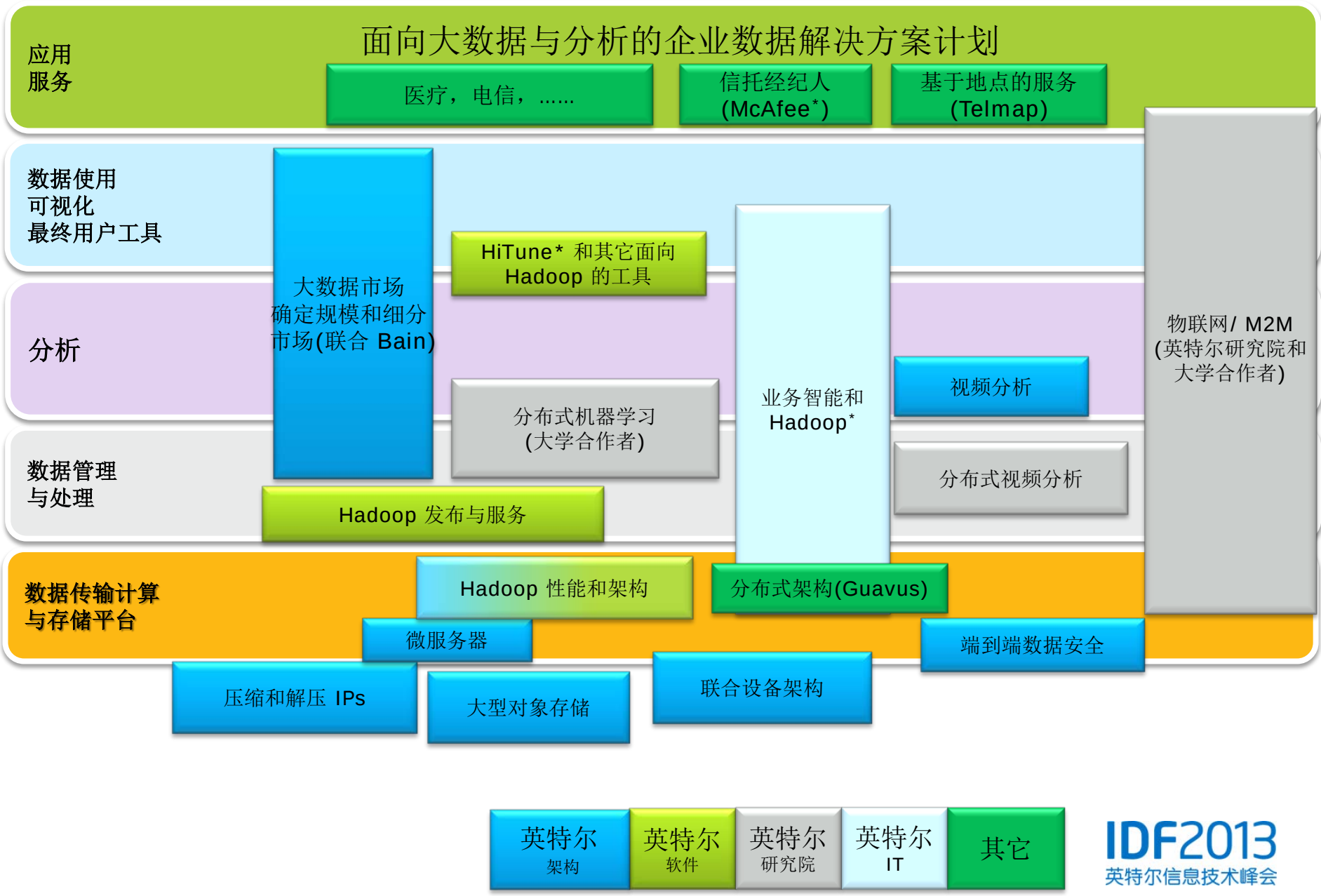
英特尔大数据行动概述



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算法，机器，人(AMPLab)

适应型/主动型
机器学习与分析

大规模和
多样化
数据

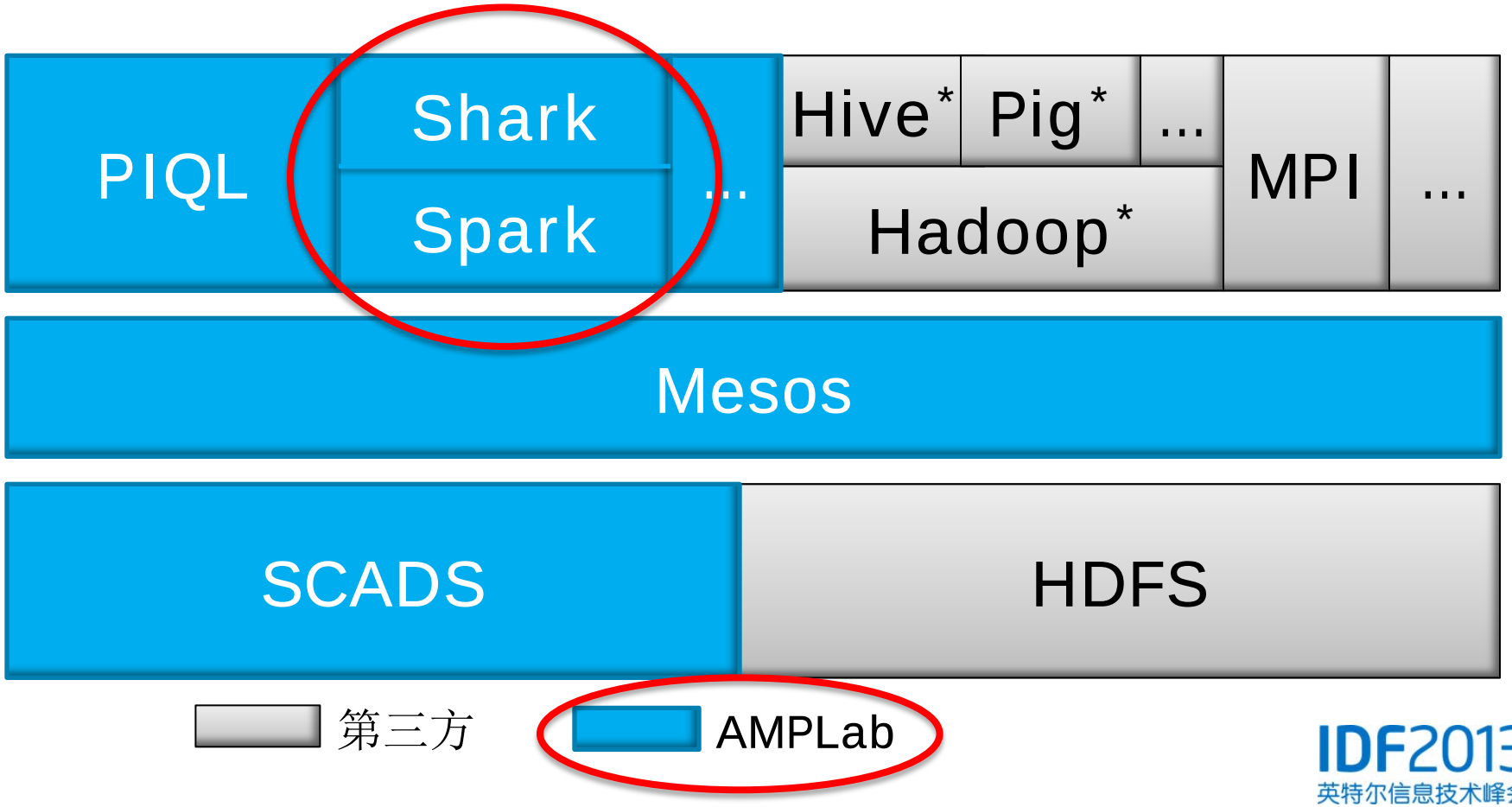
众包/
人力计算

云计算

以 BSD 开源形式发布的所有软件

Berkeley 数据分析系统

Mesos*: 资源管理平台
SCADS: 不依赖规模的存储系统
PIQL, Spark: 处理框架



数据中心编程： Spark

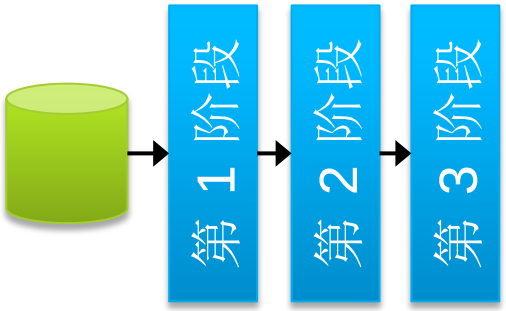
- 面向再利用工作数据集的应用的内存集群计算框架
  - *迭代*算法： 机器学习，图形处理，优化
  - *交互式*数据采掘： 排序速度超过基于磁盘的工具

- 主要理念： RDD“可恢复、分布式数据集”，发生故障后可自动重新构建
  - 存储大型工作数据集
  - 基于“数据沿袭”的容错机制

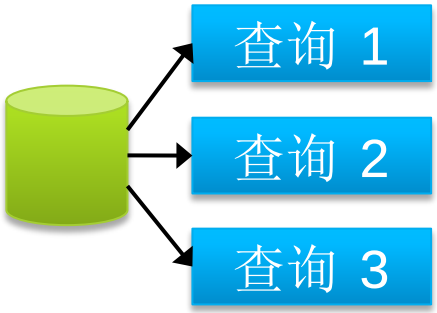
Spark: 动因

复杂任务、交互式查询和在线处理都需要一项技术是 Hadoop* MR 所不具备的：

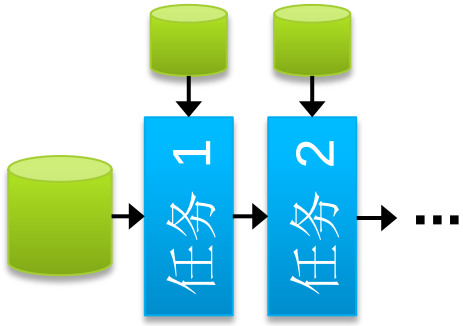
- 高效的**数据共享**



交互式任务

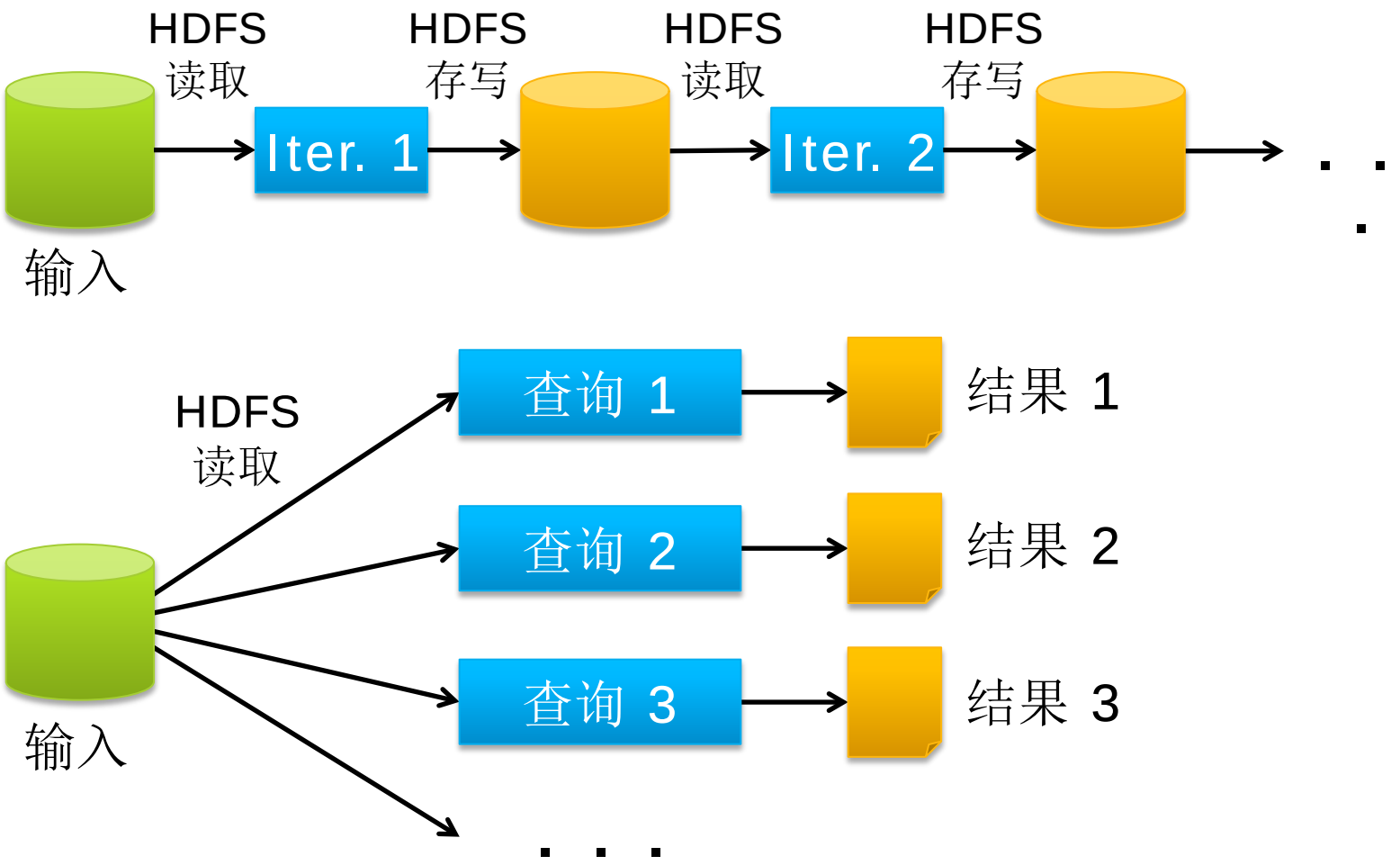


交互式采掘

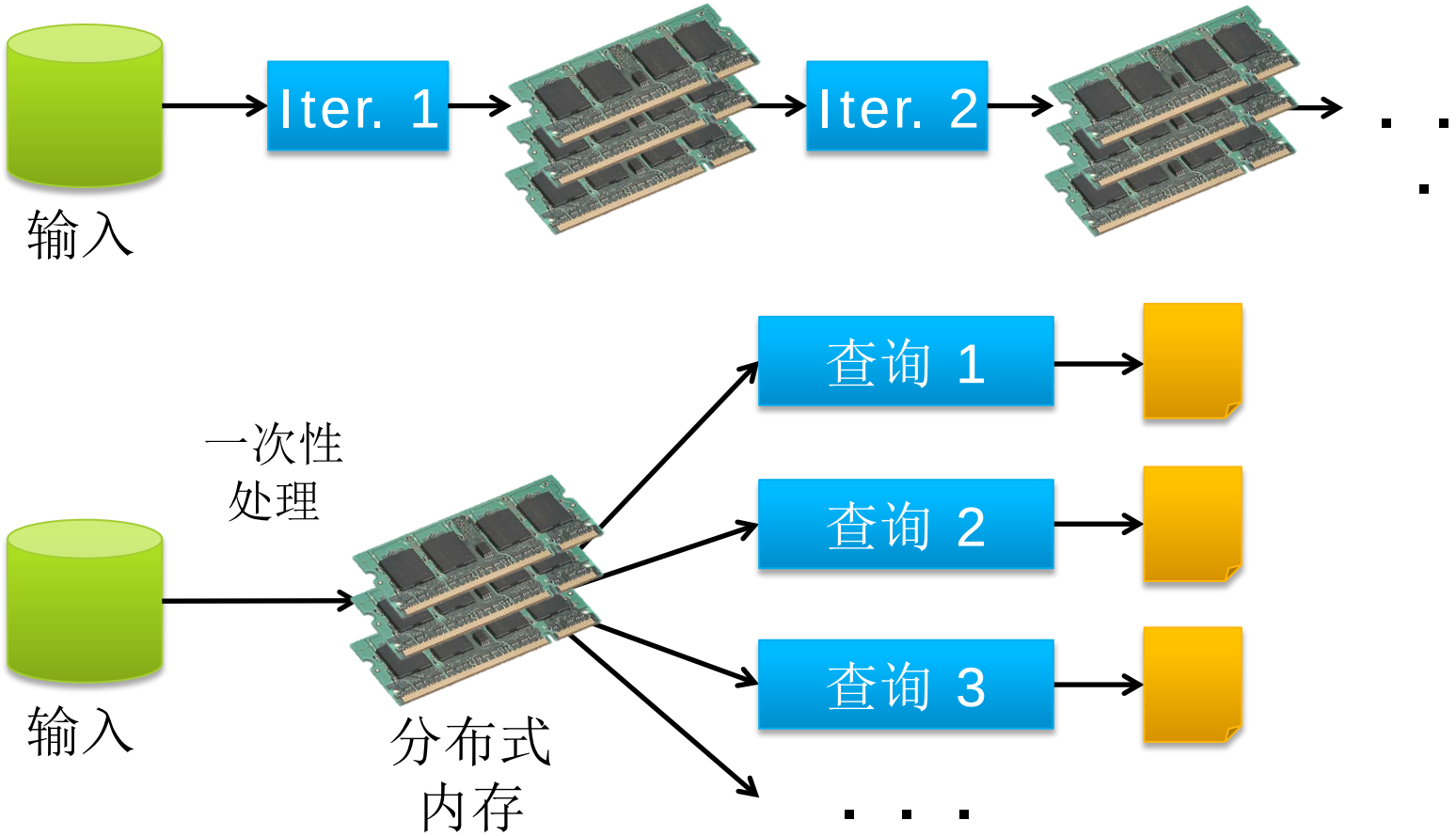


流处理

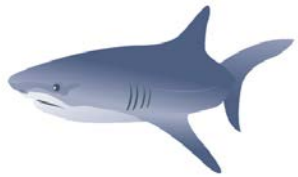
Hadoop* 中的传送与共享



Spark: 内存数据共享



引入 Shark

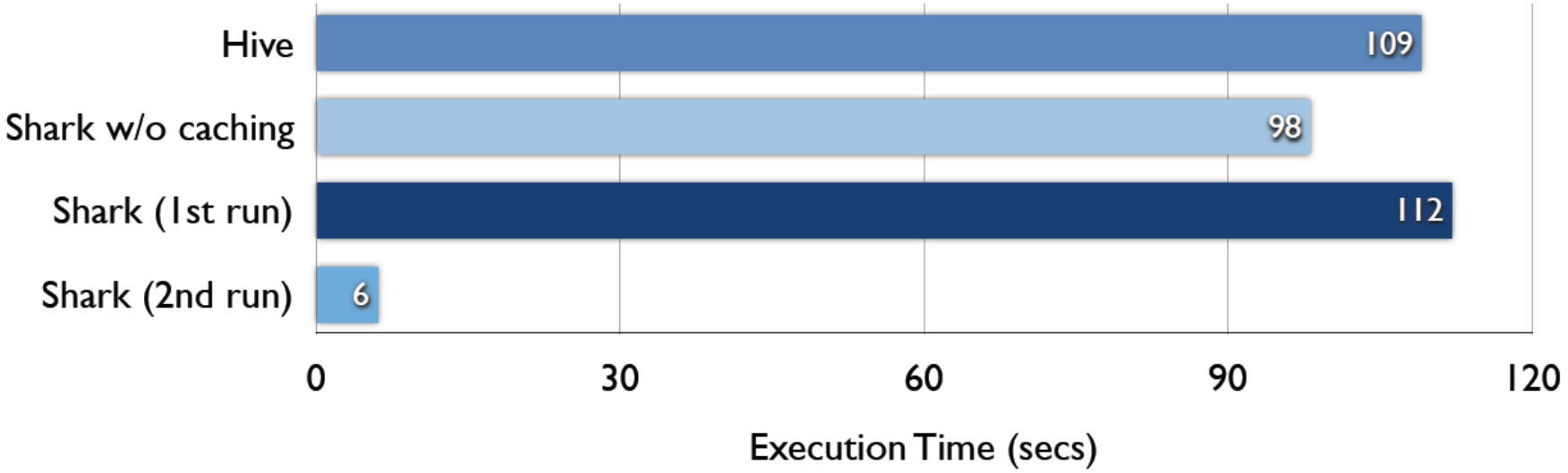


- Spark + Hive* (NoSQL 中的 SQL)
- 利用 Spark 的内存 RDD 缓存和灵活的语言功能：结果再利用，和低延迟
- 可扩展，可容错，速度快
- 查询功能兼容 Hive

性能指标评测： 查询 1

30GB 输入表

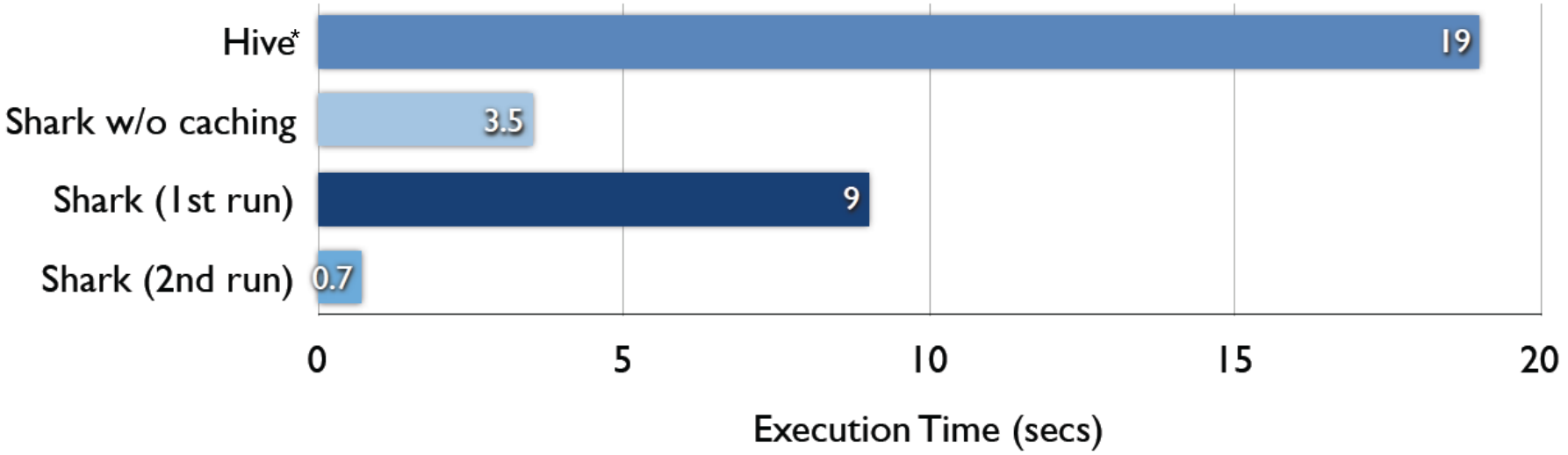
SELECT * FROM grep WHERE field LIKE ‘%XYZ%’;



性能指标评测： 查询 2

5 GB 输入表

SELECT pagerank, pageURL FROM rankings WHERE pagerank > 10;



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数据并行(MapReduce)

CPU 1 (175.5)

CPU 2 (675.5)

CPU 3 (149.9, 211.3)

CPU 4 (343.3, 255.8)

解决大量独立的子问题

GraphLab

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面向数据并行 ML 的 MapReduce

- 大型数据并行任务的理想选择!

MapReduce

特性提取

交叉验证

计算充分的统计

还可以继续完善机器学习吗

?

机器学习流程

图片

docs

视频

排名

面孔

重要
话语

边信息

相似面孔

共享话语

家庭影片

置信传播

LDA

协同过滤

面部标签

doc

主题

推荐视频

并行化机器学习

图形输入

多数为并行数据

结构化图形计算

并行图形

解决并行图形 ML

Map Reduce

并行图形抽象

特性提取

交叉验证

计算充分的统计

图形模式

Gibbs Sampling

置信传播

Variational Opt.

协同过滤

张量分解

半监督学习

标签传播

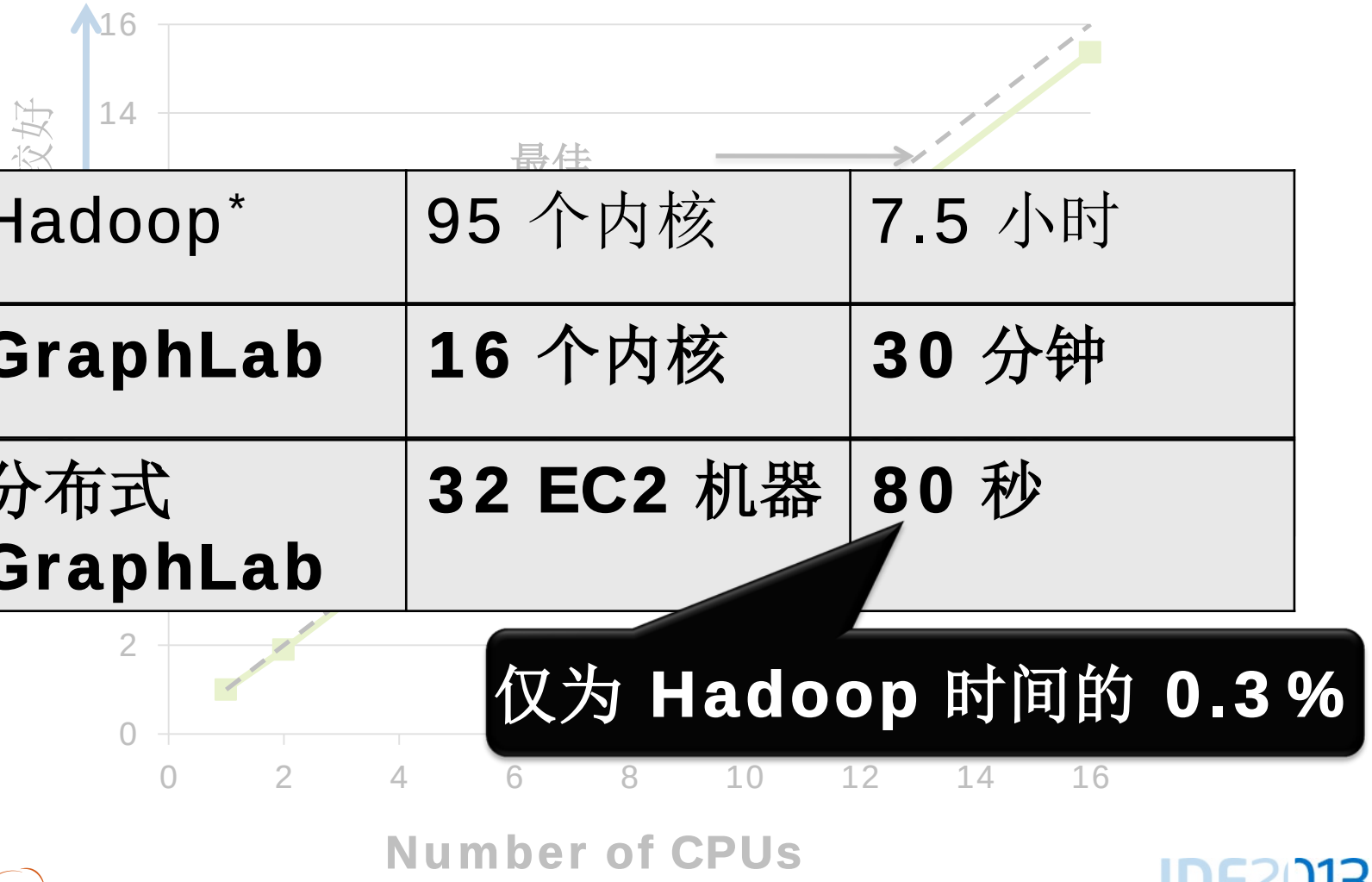
CoEM

数据采掘

网页排名

三角形计数

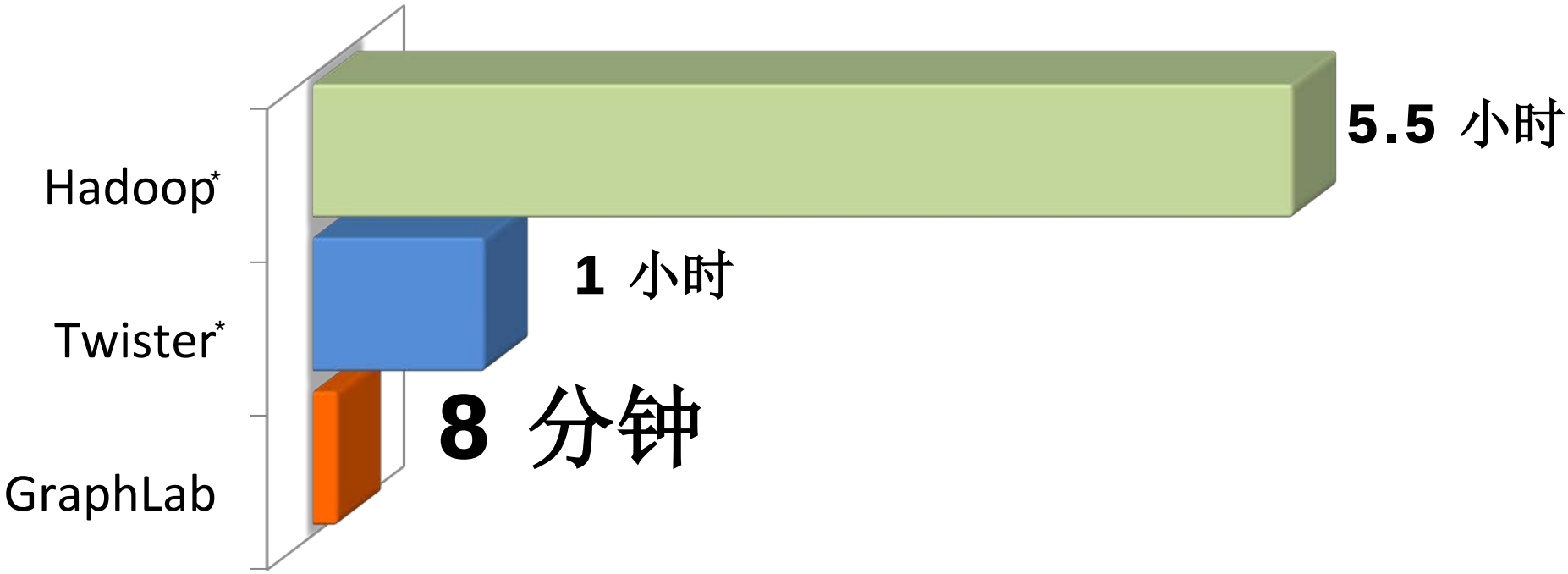
示例:
终身学习计划(CoEM)



Hadoop*	95 个内核	7.5 小时
GraphLab	**16 个内核**	**30 分钟**
分布式 **GraphLab**	**32 EC2 机器**	**80 秒**

仅为 Hadoop 时间的 0.3%

示例： 网页排名



4 千万次网页，14 亿个链接

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英特尔对 Hadoop*的贡献

- 英特尔® Distribution for Apache Hadoop*
  - 性能，安全和管理
  - 下载地址： http://hadoop.intel.com/
- 英特尔面向 Hadoop 的开源计划
  - HiBench: Hadoop 综合基准指标套件
    - https://github.com/intel-hadoop/hibench
  - Project Panthera: 有效支持基于 Hadoop 的标准 SQL 特性
    - https://github.com/intel-hadoop/project-panthera
  - Project Rhino: 为 Apache Hadoop 生态系统增强数据保护
    - https://github.com/intel-hadoop/project-rhino
  - Graph Builder: 基于 Hadoop 的可扩展图形构建工具
    - http://graphlab.org/intel-graphbuilder/

使用 Spark/Shark 进行内存实时数据分析

- 使用案例 1: 专门和交互式查询
  - 交互式查询(探索性专门查询，商业智能图表和采掘)
  - 同类项目： Google* Dremel, Facebook* Peregrine, Cloudera* Impala, Apache* Drill, 等(数秒延迟)
  - 使用 Shark/Spark 为交互式查询实现次秒级的延迟
- 使用案例 2: 内存实时分析
  - 迭代数据采掘，在线分析(例如：将图表载入内存以支持在线分析，高速缓存中间结果以支持迭代机器学习)
  - 同类项目： Google PowerDrill
  - 使用 Shark/Spark 可靠地将数据载入分布式内存以支持在线分析

使用 Spark/Shark 进行内存实时数据分析

- 使用案例 3: 流处理
  - 流分析，CEP (例如：入侵检测，实时统计，等)
  - 同类项目： Twitter* Storm, Apache* S4, Facebook* Puma
  - 使用 Spark 简化流处理
    - 更佳的可靠性
    - 面向离线、在线和流分析的统一框架
- 使用案例 4: 并行图形分析与机器学习
  - 使用案例： 图形算法，机器学习(例如：社交网络分析，推荐引擎)
  - 同类项目： Google* Pregel, CMU GraphLab*
  - 使用 Bagel (Pregel on Spark) 支持 Spark 环境下的并行图形分析和机器学习

总结

- Hadoop* 中部署的 MapReduce 十分有用，不过：
  - 内存实施显示出重要优势
  - 图形算法可能更适合现有问题
- 英特尔继续和大学研究人员合作
- 英特尔致力于在生产环境中落实研究成果

行动号召

- 在您的大数据研究中引入英特尔研究成果！
- 和我们一起利用 Spark/Shark 研究下一代内存实时分析

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