High Throughput Computing Data Center Architecture

Zhulin (Zane) Wei, Shujie Zhang, Yuangang (Eric) Wang, Qinfen (Jeff) Hao, Guanyu Zhu, Junfeng Zhao, Haibin (Benjamin) Wang, Xi Tan (Jake Tam), Jian Li*, etc

Shannon Lab

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Details see white paper in ISCA package; Contacts for further brainstorming: Jake Tam (tanxi@huawei.com) or Eric Wang (wangyuangang@huawei.com)

Outline

Big Data Challenges to Data Center Architecture

Huawei’s Vision on Future Data Center

DC 3.0: HTC-DC

Evolution of Human Society

4000 BC~1763

Agricultural Society:
Avg. consumption of Protein per Capita

Protein consumption as a identity for the development of civilization

1764~1970

Industrial Society:
Avg. consumption of Electricity per Capita

1970（kWh）
- US：723
- EU：2888
- CN：151(1971)*

1971~2011

Information Society:
Avg. Internet access/per Capita

2011 (Every 100 Person) *
- US：78
- EU：72
- CN：38

2012~present

Post-Info Society:
Avg. consumption of Info-Data per Capita

2012 (Person Per Year) **
- US：1960GB
- EU：1930GB
- CN：186GB

Technological innovation promotes the development of civilization

* Source: http://data.worldbank.org

** Source: IDC, 2012

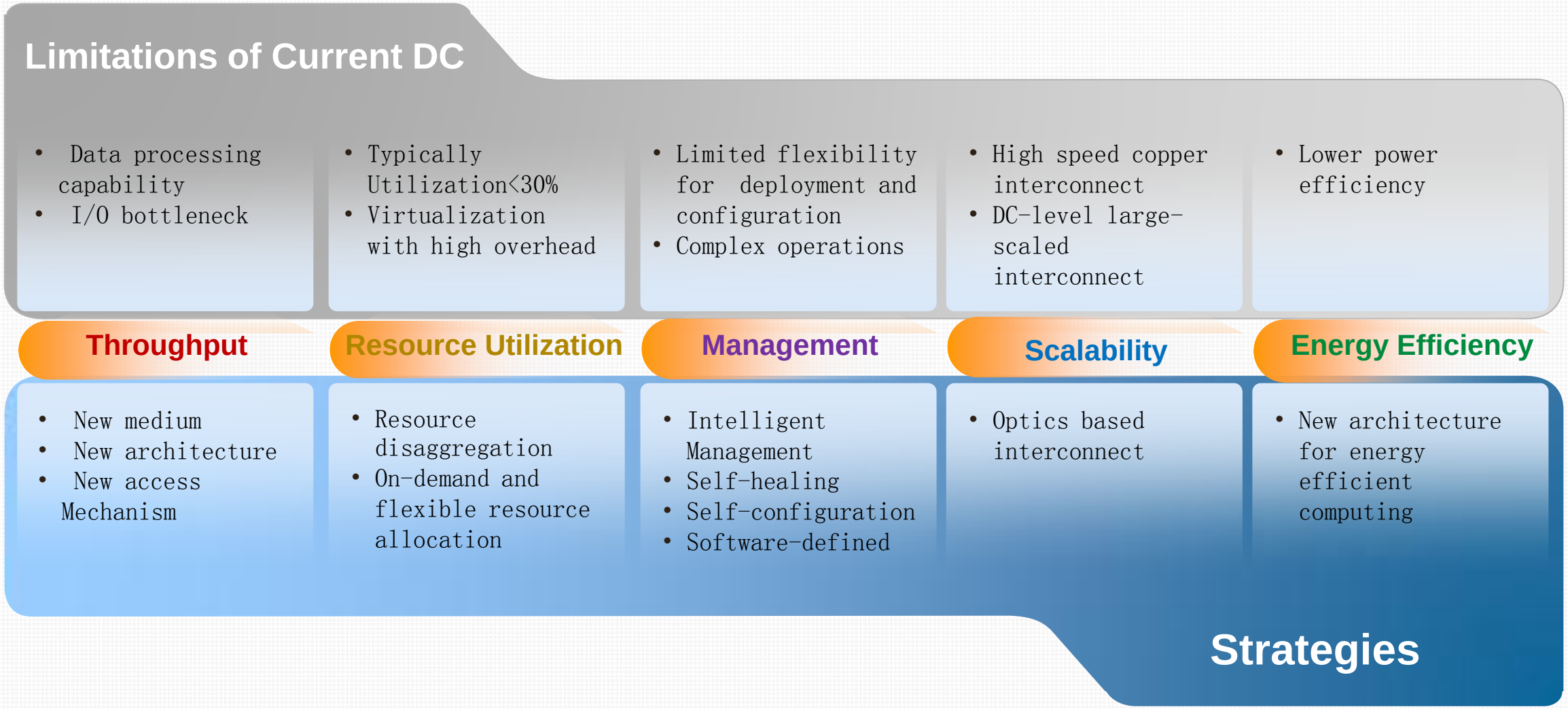
Big Data Era: Enjoy Life via Data Consumption

PB level
→ Enjoy Intelligent Life

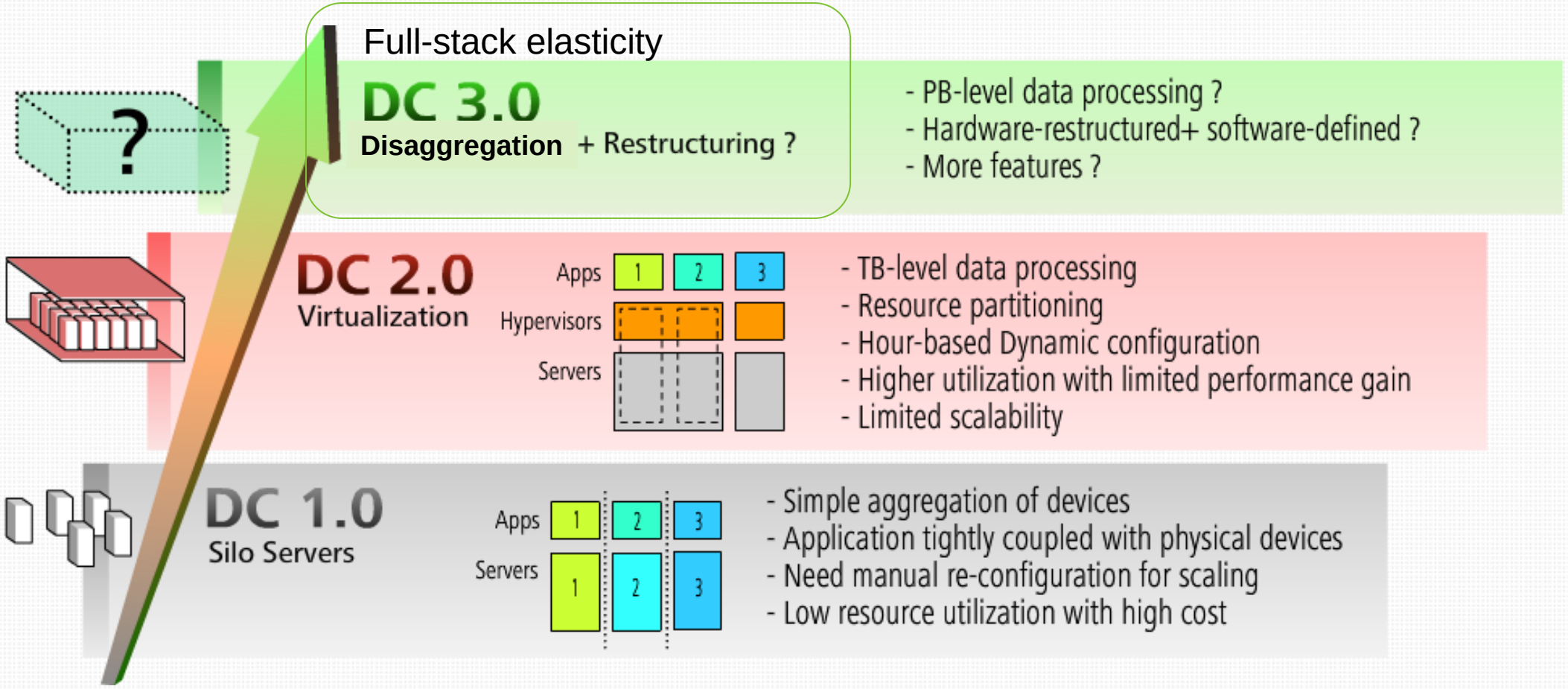
TB level
→ Enter the Age of Data

GB level
→ Obtain Real-time Info

Big Data Challenges to Data Centers



Evolution of Data Center Architecture



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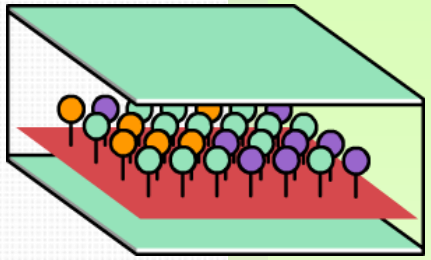


DC 3.0

Resource Disaggregated

Big Data Oriented

Intelligent Management

Open Standard-Based Flexible ServiceLayer

Adaptation for Task Variation

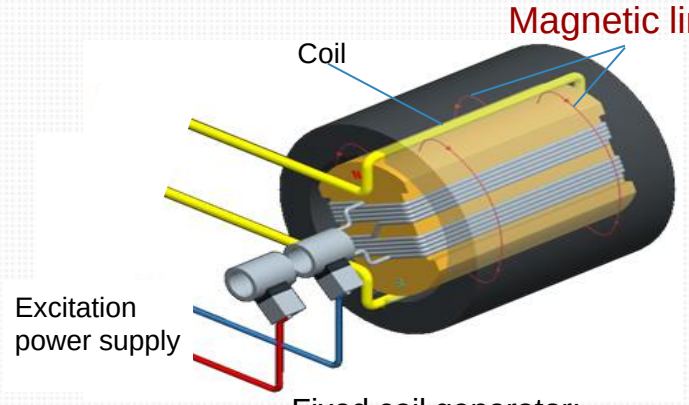
Green

Highly Scalable

Big Data Oriented Architecture

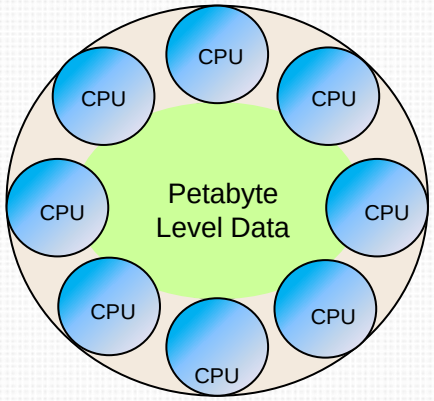
Big Data Oriented

Generator Revolution，
ending the bottleneck of power generating



Fixed coil generator:
break through the scale limitation of coil

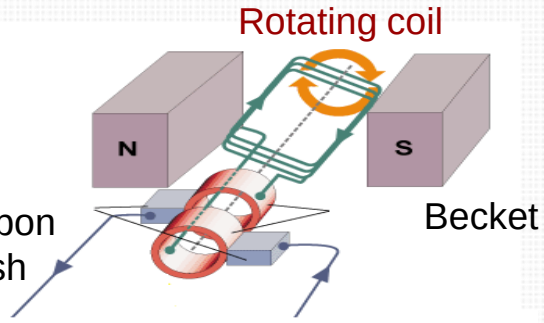
IT System Revolution，
ending the bottleneck of data processing



Data-centric system:
break through the bottleneck of data throughput

Coil → New Architecture → Data

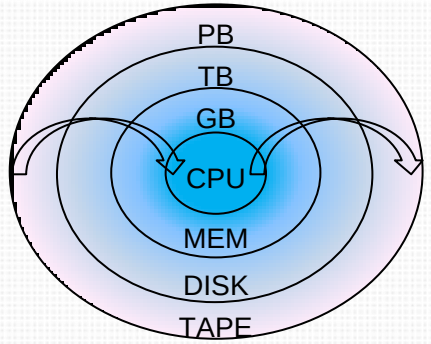
MWH → PB



Conventional generator:
scale limitation of coil

Magnetic field → Old Architecture → Computing

KWH → TB



Computing-centric system:
limitation of data throughput

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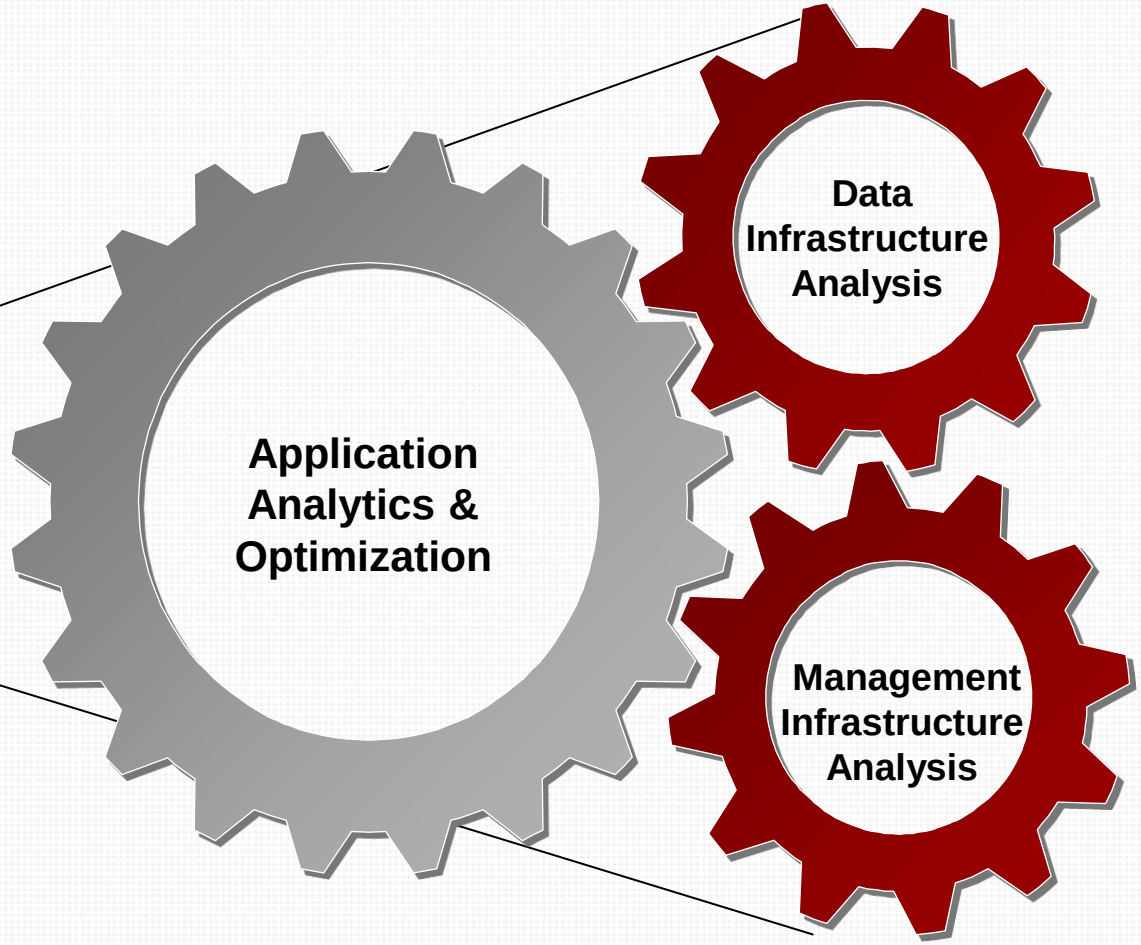
Intelligent Management



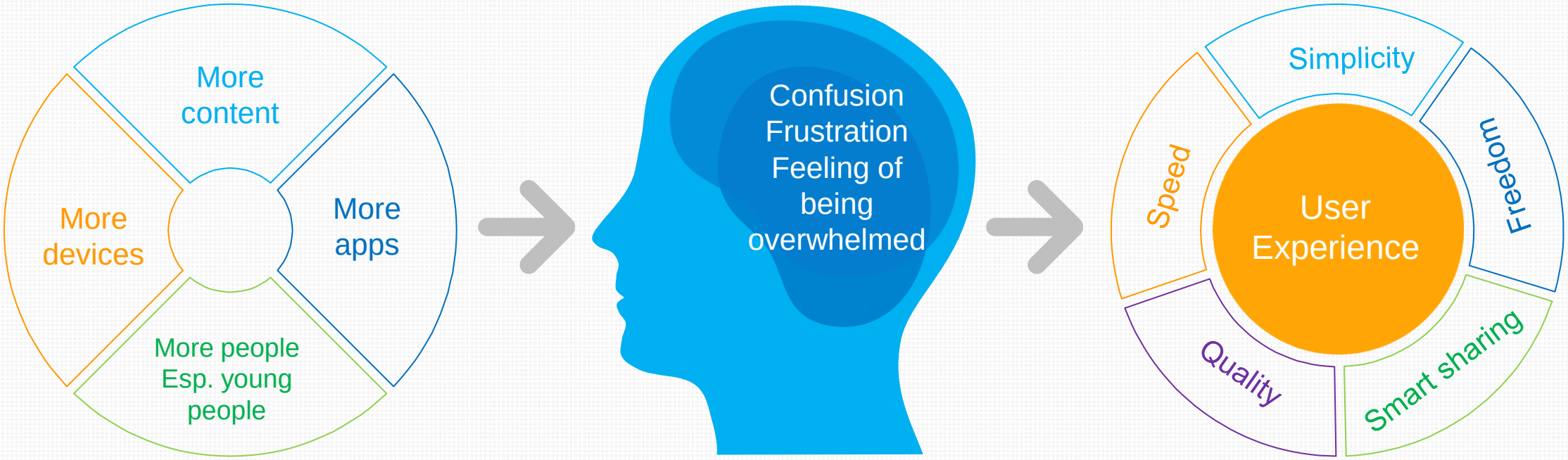
Open, Standard based and Flexible Service Layer

Open
Standard-Based
Flexible
ServiceLayer

So much more

Generates

Service



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Adaptation for Task Variation

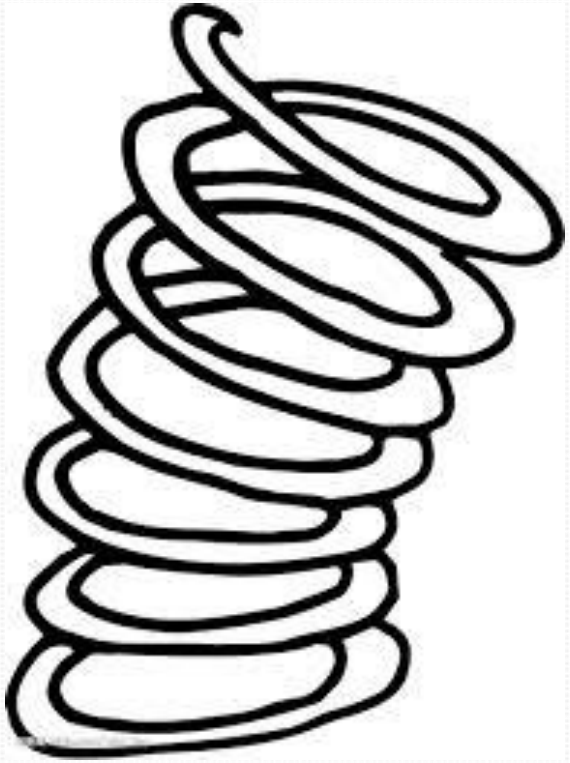
Data Center

Adapts to different application and workload like a chameleon

High Scalability

Highly Scalable

Scale up easily



Have ability can run between peak pressure and usual time

Green

Traditional data center consume power much

Build Green data center

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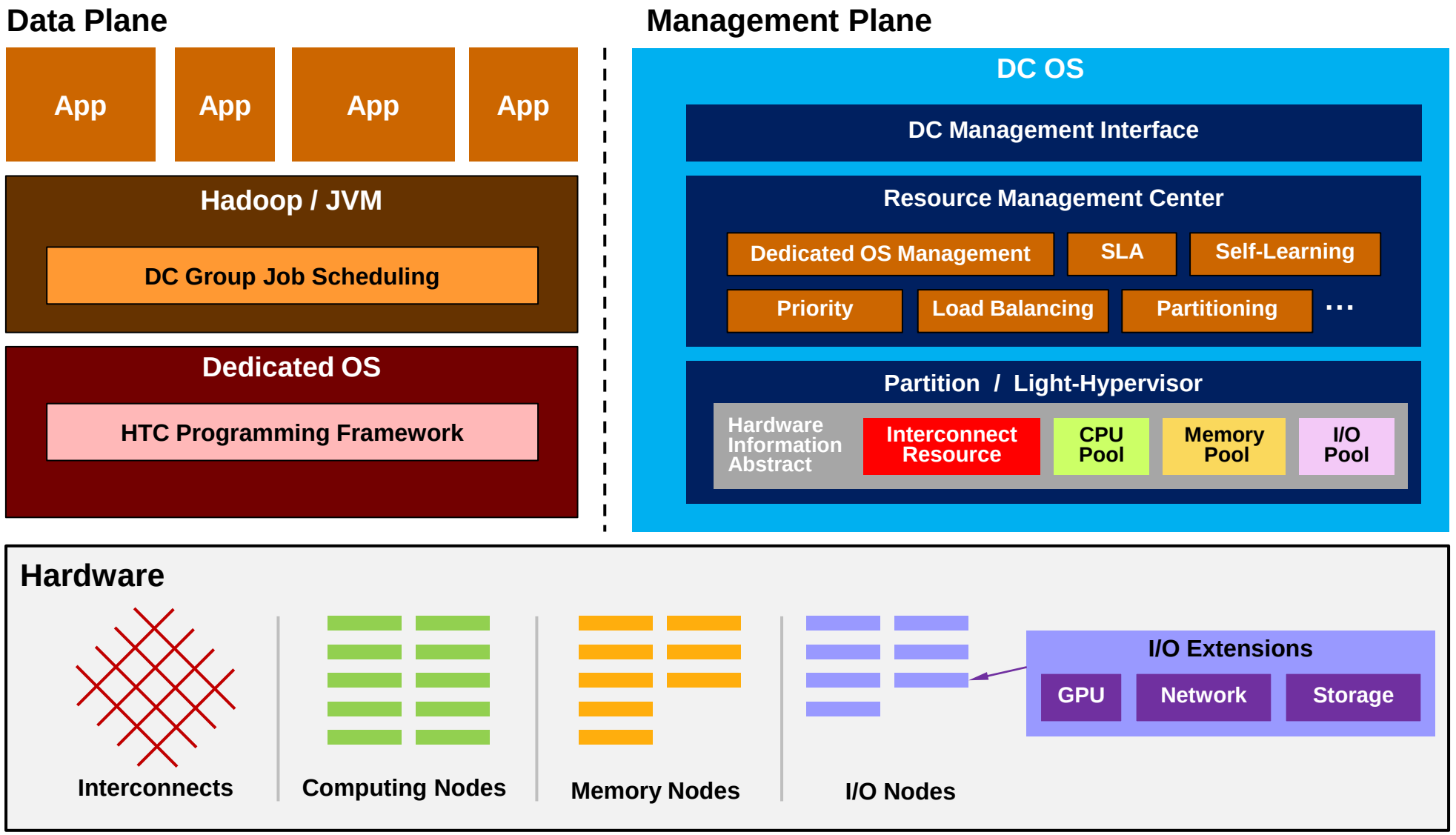
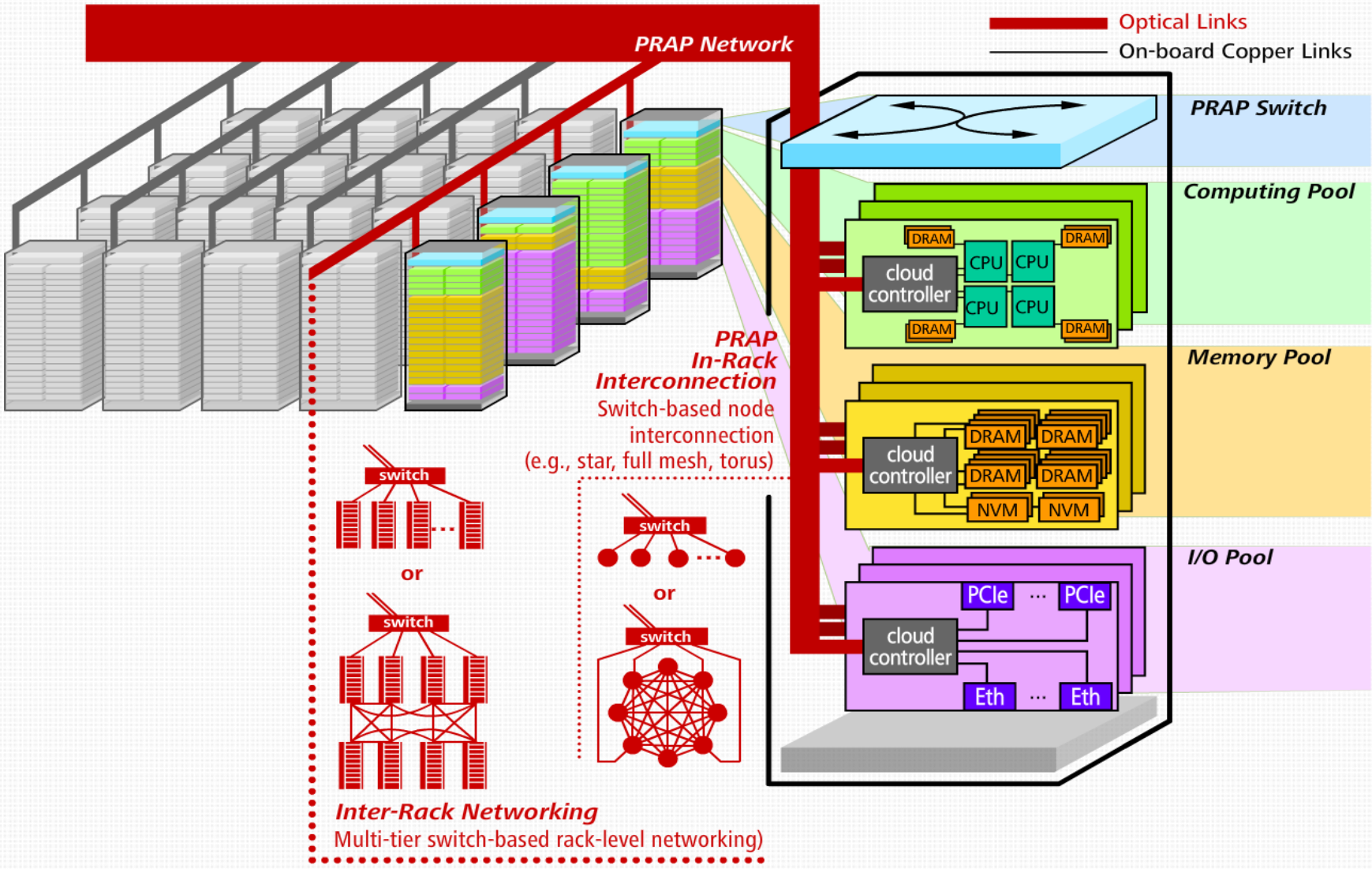
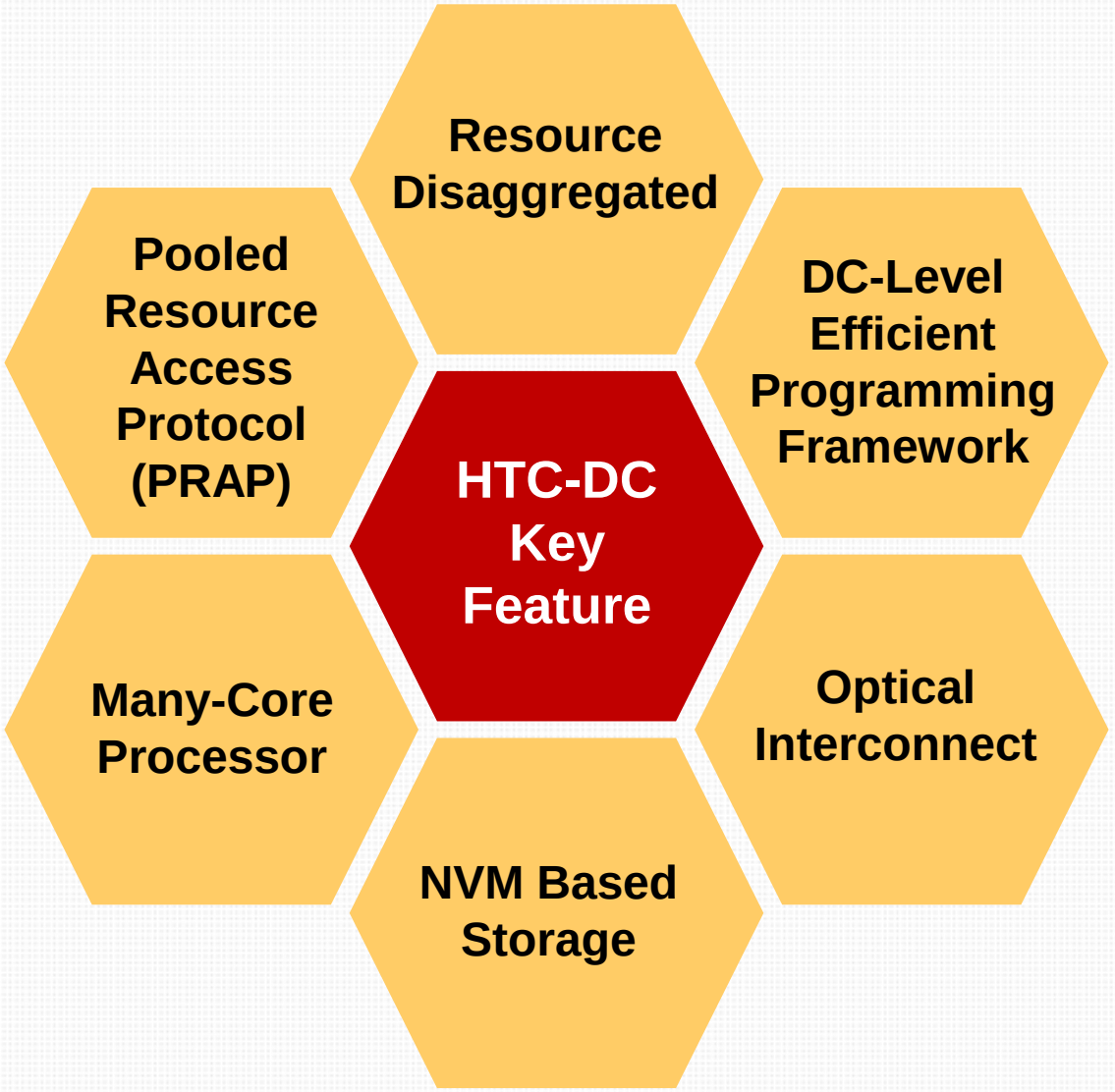
HTC-DC Architecture



Hardware Architecture of HTC-DC

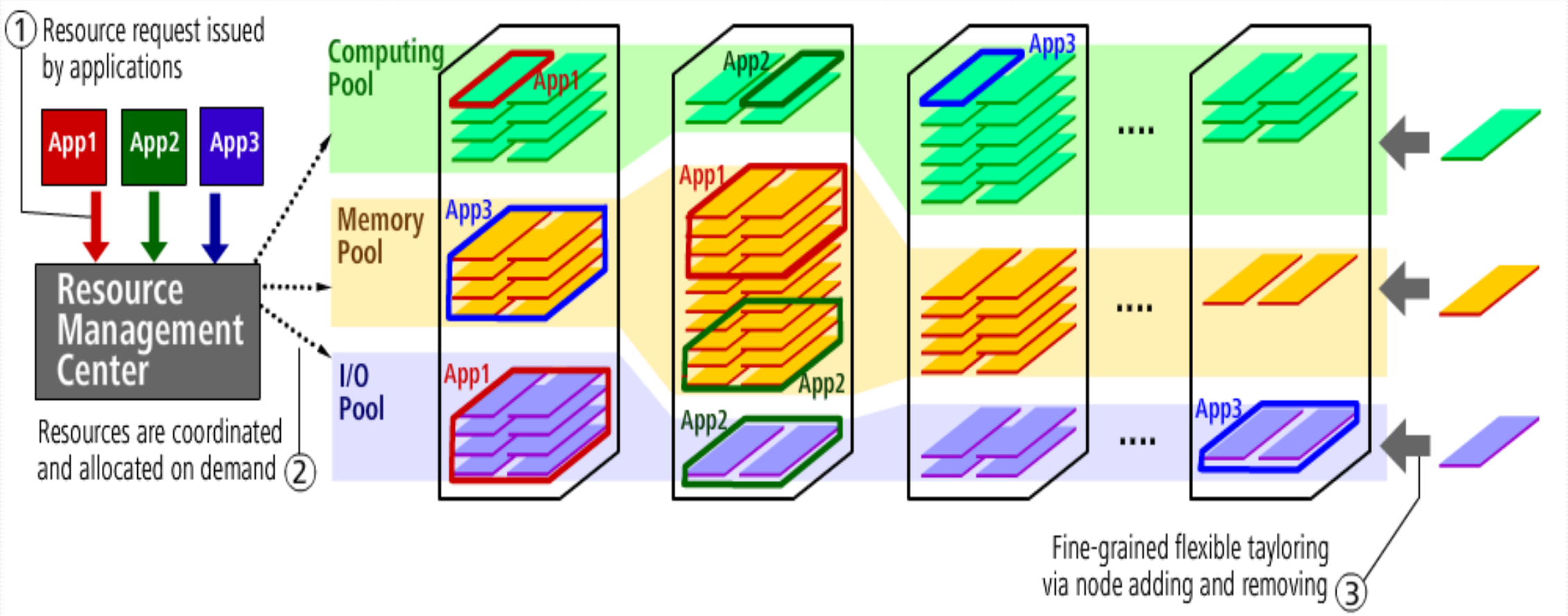


HTC-DC Key Feature

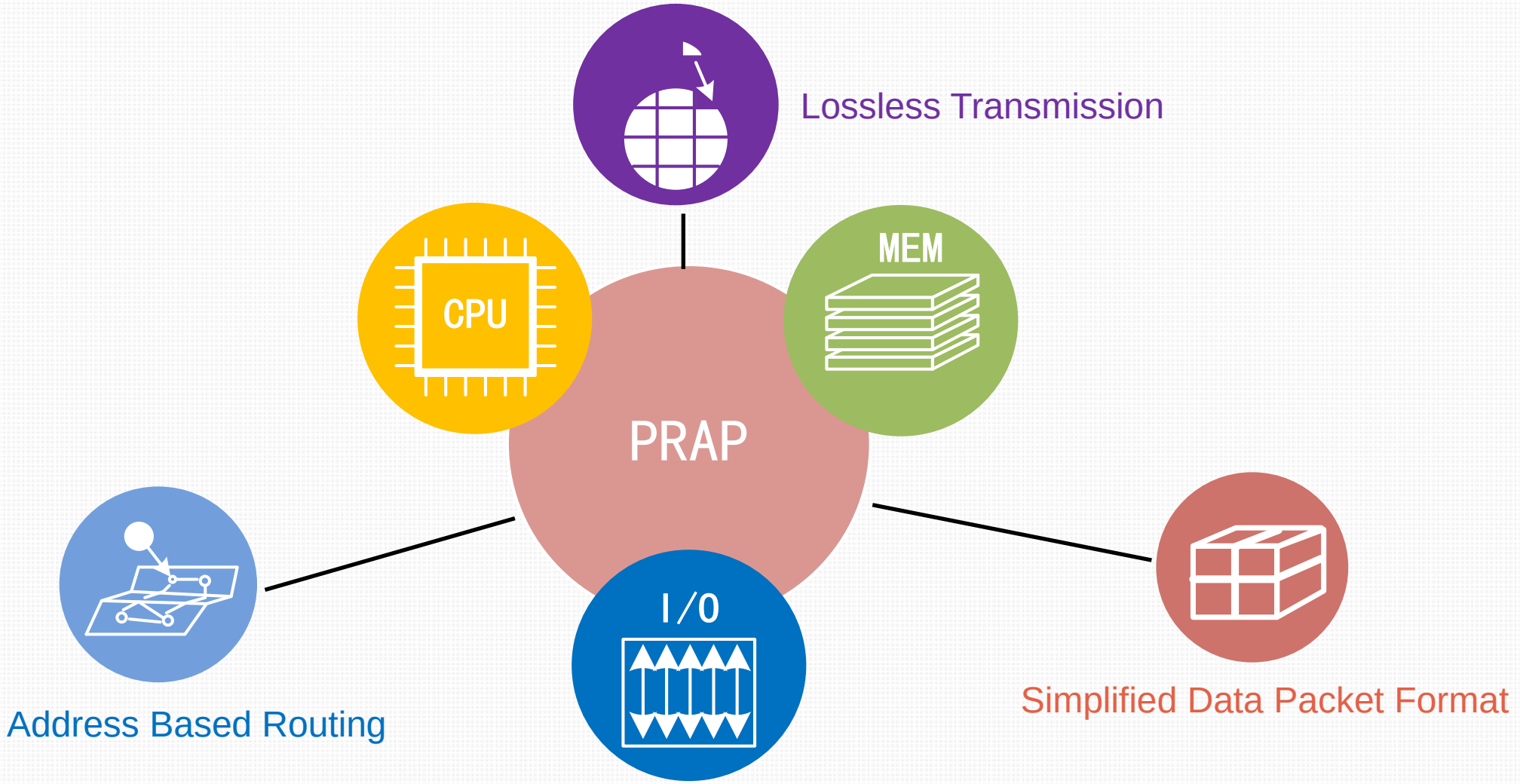


Resource Disaggregated

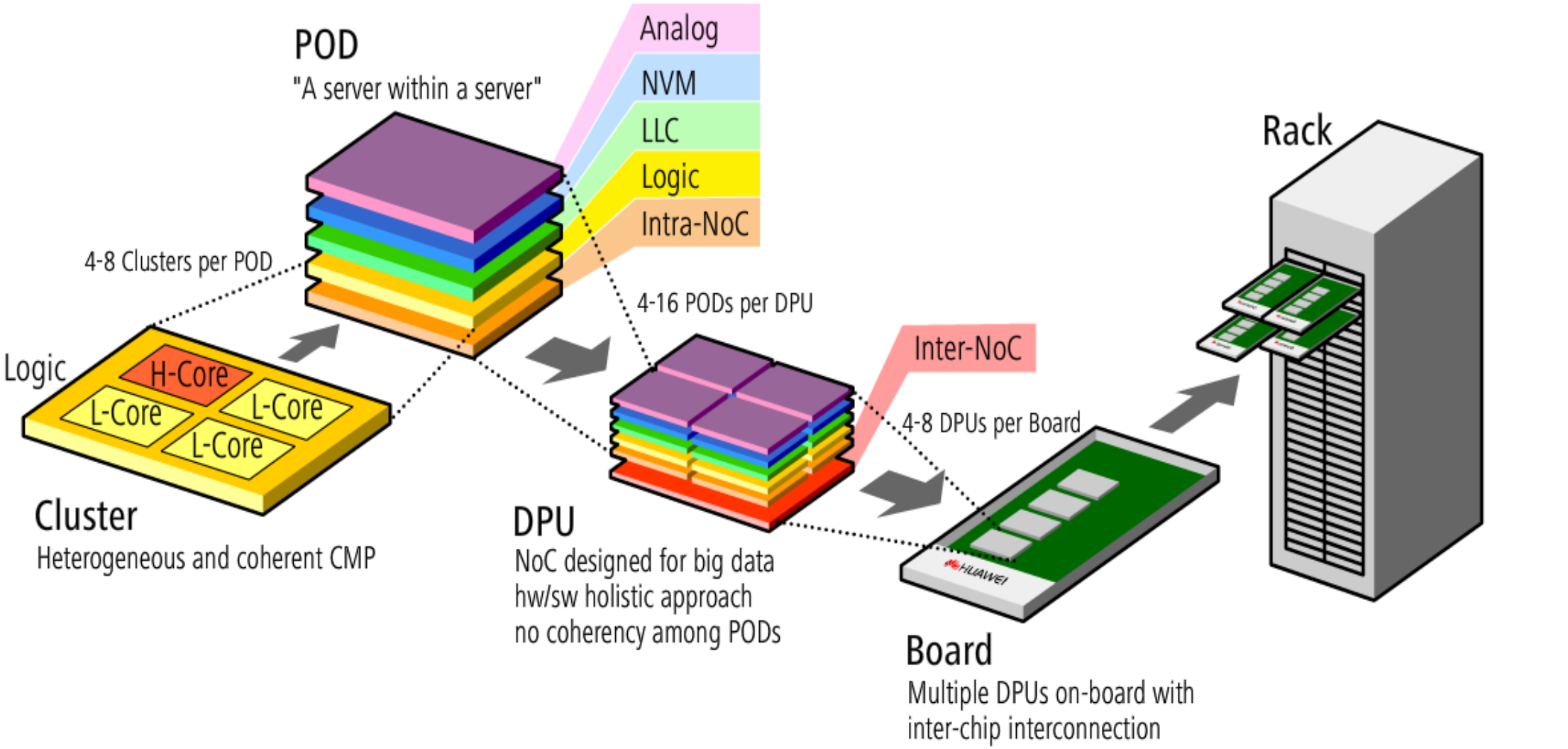
On-demand Resource Allocation Based on Disaggregation



Pooled Resource Access Protocol (PRAP)



Many-Core Processor



Summary

- HTC-DC： A new, green and intelligent DC 3.0 for Big Data era

- HTC-DC is a new generation of DC architecture:
  - Resource disaggregated
  - Pooled Resource Access Protocol (PRAP)
  - Many-core processors
  - NVM as Storage
  - Optical interconnects
  - DC-level efficient programming framework

- PB-level data processing, intelligent management, high scalability, and green

- **We welcome brainstorming, critics, suggestions and comments ☺**

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Thank you

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