

# High Throughput Computing Data Center Architecture

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# 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

## Big Data



All Related Data

Intensity-related Data

Cleaned Data

### PB level

→ Enjoy Intelligent Life



### TB level

→ Enter the Age of Data



### GB level

→ Obtain Real-time Info



# Big Data Challenges to Data Centers

## Limitations of Current DC

- |   |  |   |   |  |
|---|--|---|---|--|
| <ul style="list-style-type: none"><li>• Data processing capability</li><li>• I/O bottleneck</li></ul> | <ul style="list-style-type: none"><li>• Typically Utilization&lt;30%</li><li>• Virtualization with high overhead</li></ul> | <ul style="list-style-type: none"><li>• Limited flexibility for deployment and configuration</li><li>• Complex operations</li></ul> | <ul style="list-style-type: none"><li>• High speed copper interconnect</li><li>• DC-level large-scaled interconnect</li></ul> | <ul style="list-style-type: none"><li>• Lower power efficiency</li></ul> |
|---|--|---|---|--|

### Throughput

- New medium
- New architecture
- New access Mechanism

### Resource Utilization

- Resource disaggregation
- On-demand and flexible resource allocation

### Management

- Intelligent Management
- Self-healing
- Self-configuration
- Software-defined

### Scalability

- Optics based interconnect

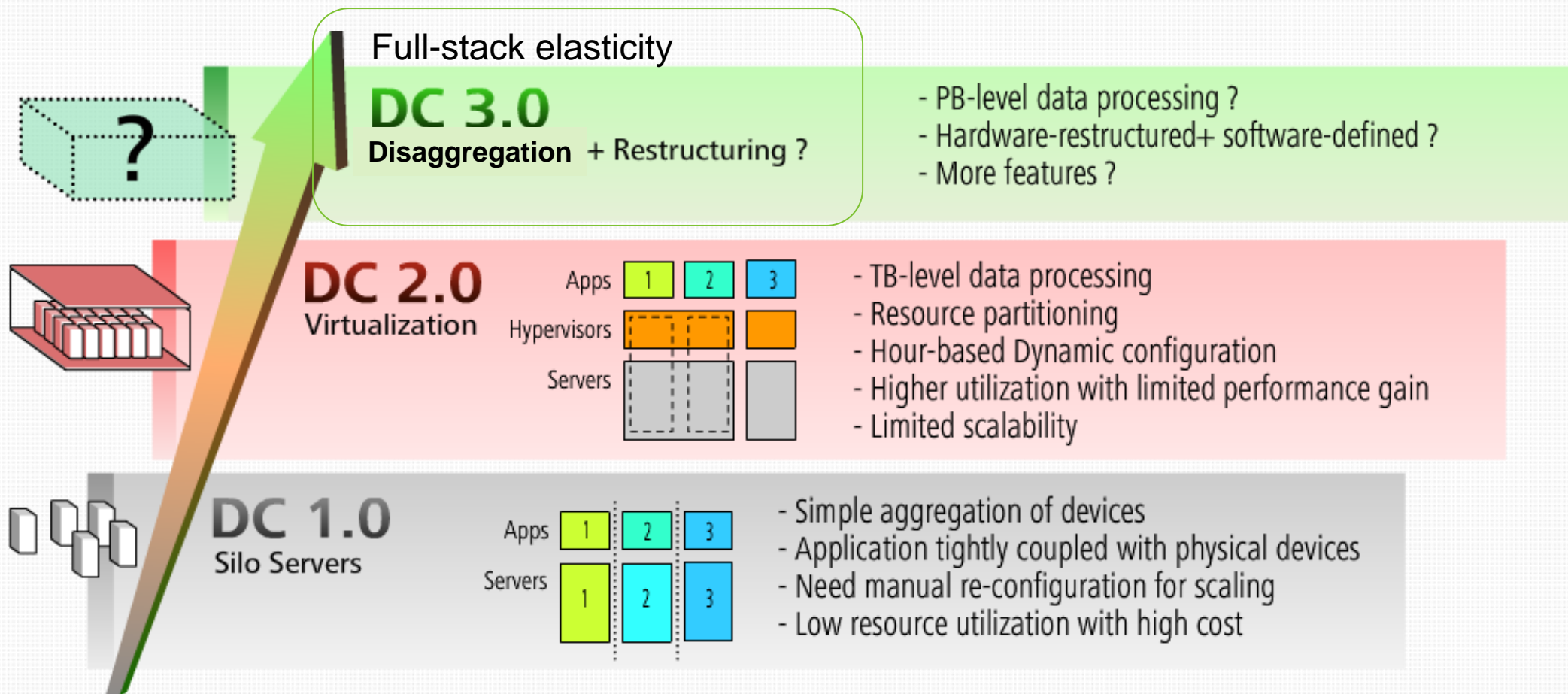
### Energy Efficiency

- New architecture for energy efficient computing

## Strategies



# Evolution of Data Center Architecture



# Outline

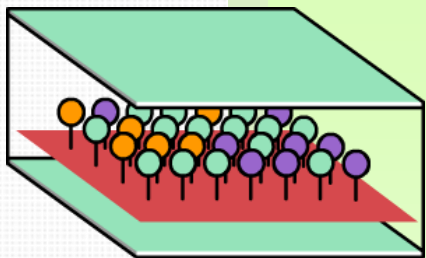
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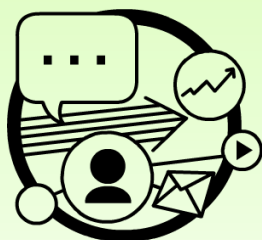


# Huawei's Vision on Future Data Centers



## DC 3.0

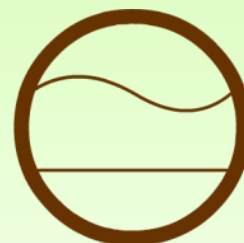
Resource Disaggregated



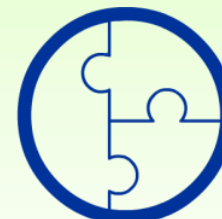
Big Data  
Oriented



Intelligent  
Management



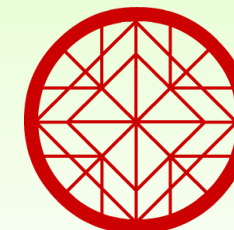
Open  
Standard-Based  
Flexible  
ServiceLayer



Adaptation  
for Task  
Variation



Green

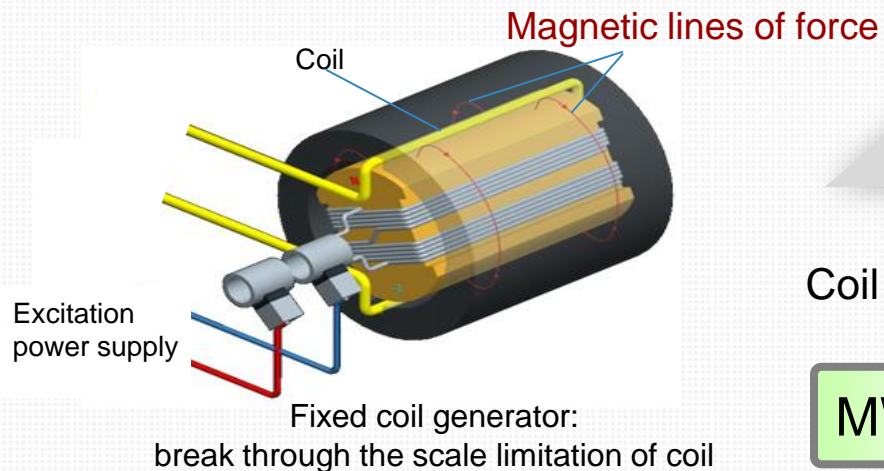


Highly  
Scalable



# Big Data Oriented Architecture

**Generator Revolution,  
ending the bottleneck of power generating**



Coil

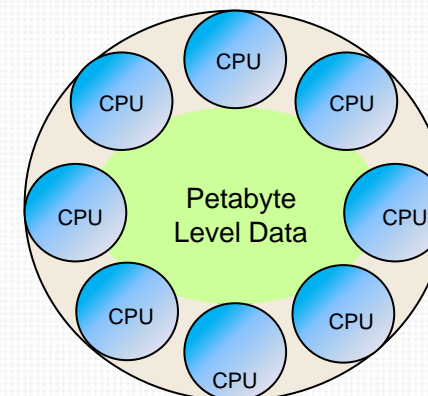
MWH

New  
Architecture

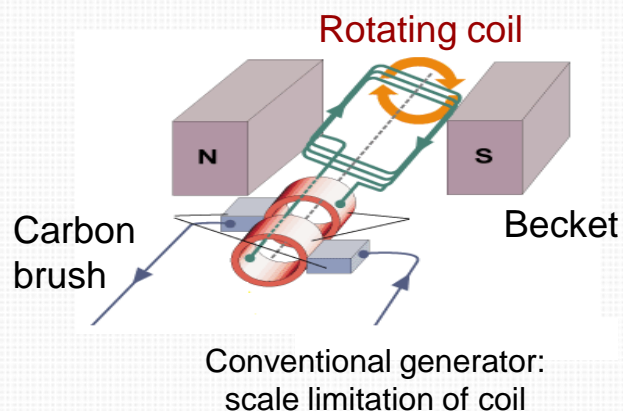
Data

PB

**IT System Revolution,  
ending the bottleneck of data processing**



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



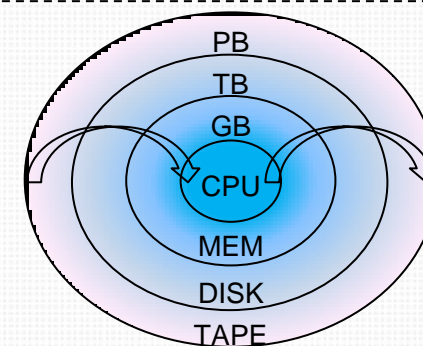
Magnetic field

KWH

Old  
Architecture

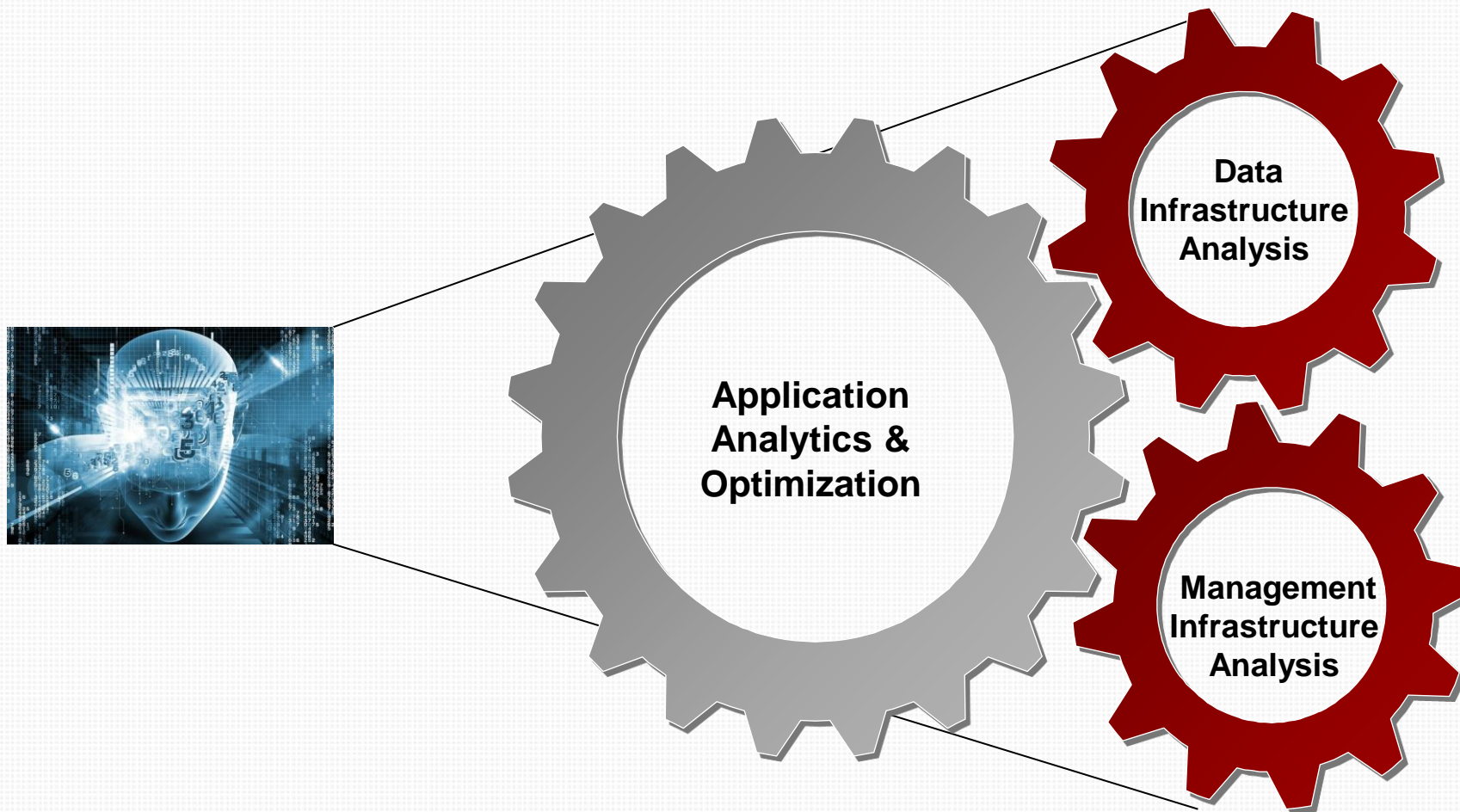
Computing

TB



Computing-centric system:  
limitation of data throughput

# Intelligent Management



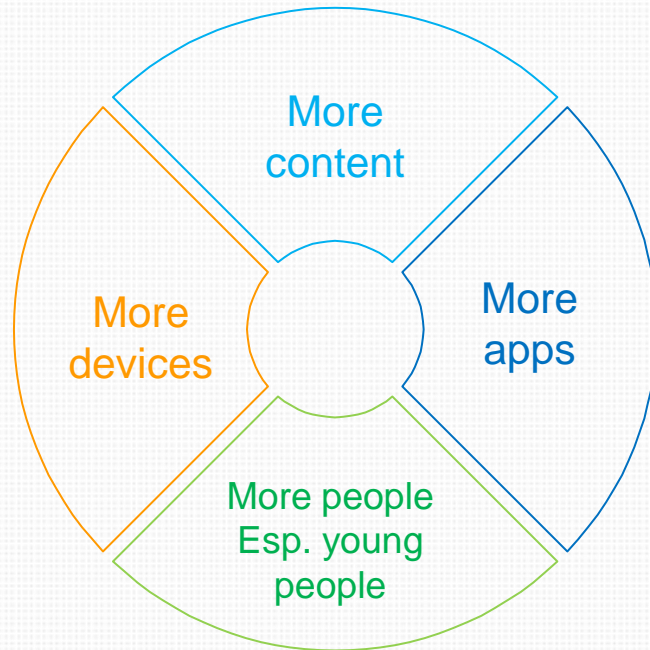


# Open, Standard based and Flexible Service Layer

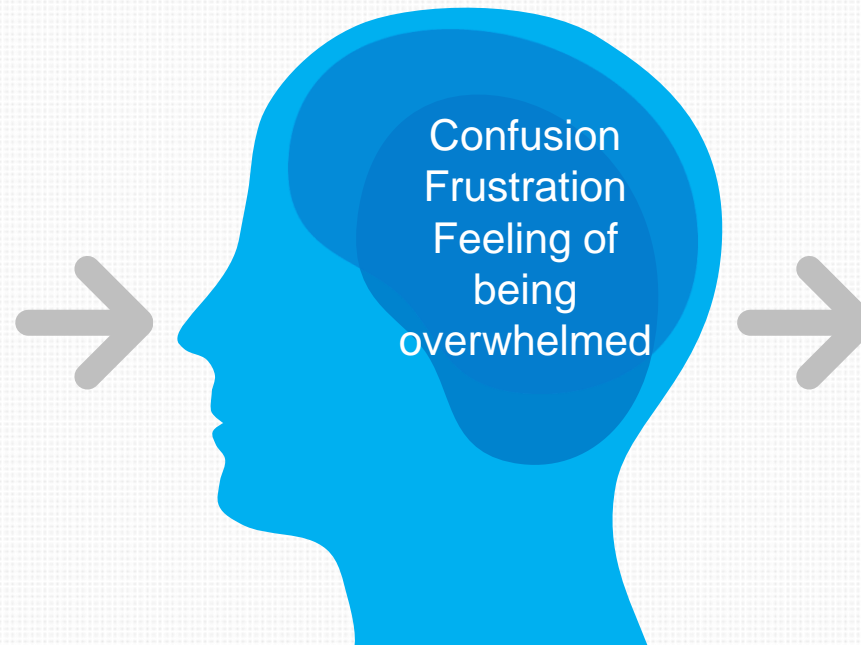


Open  
Standard-Based  
Flexible  
ServiceLayer

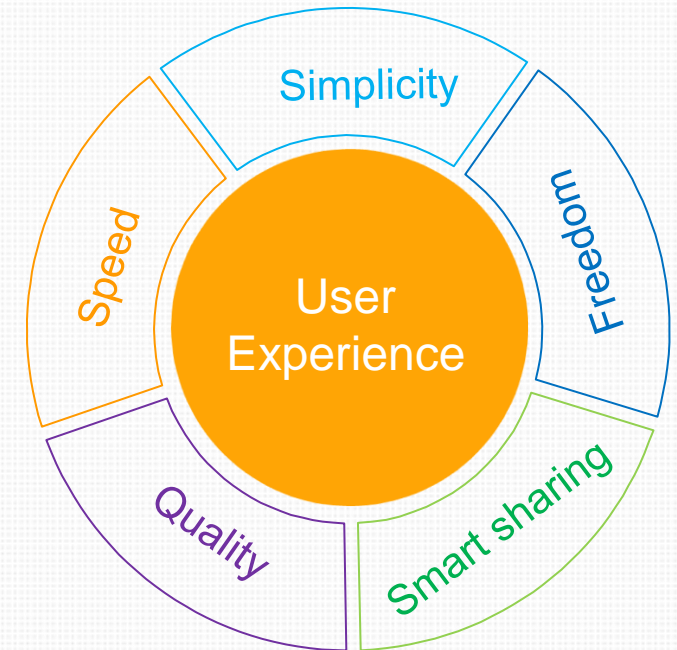
So much more



Generates



Service





# Adaptation for Task Variation



Adaptation  
for Task  
Variation



Data Center



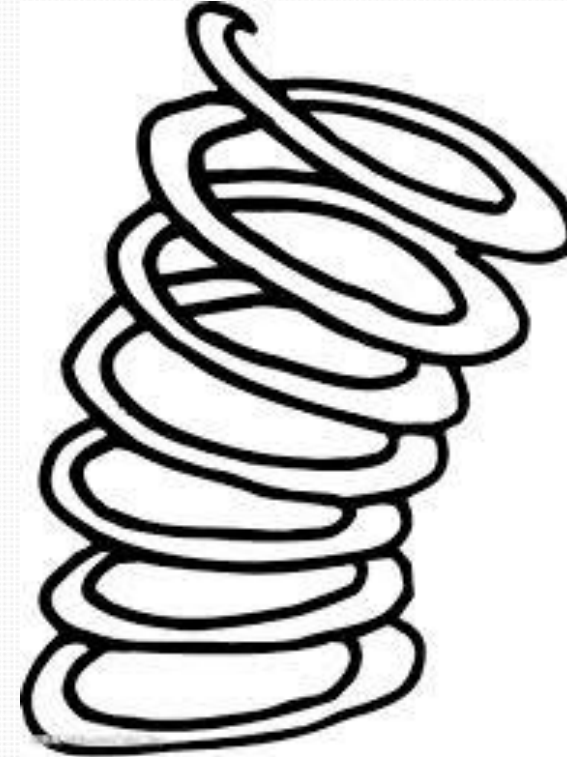
Adapts to different application  
and workload like a chameleon



# High Scalability



Scale up easily



Have ability can run between peak pressure and usual time

# Green



Traditional data center consume power much



Build Green data center



# Outline

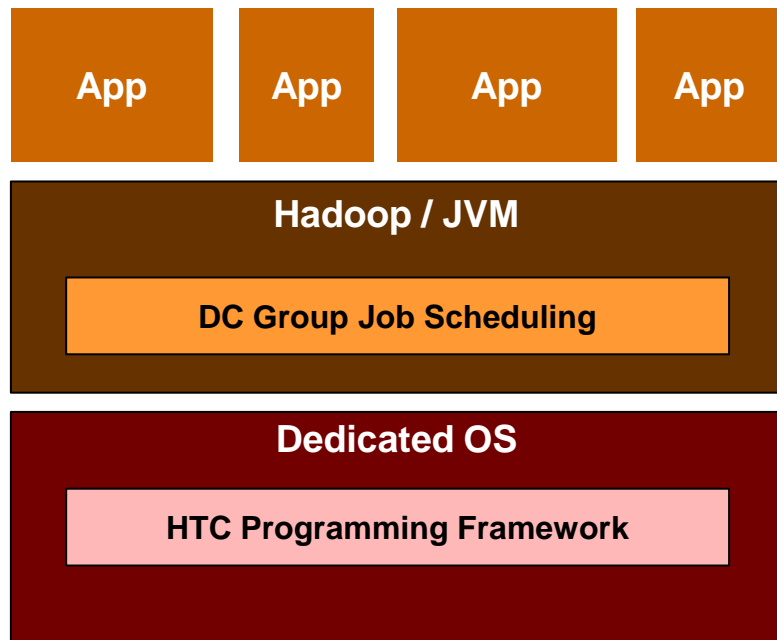
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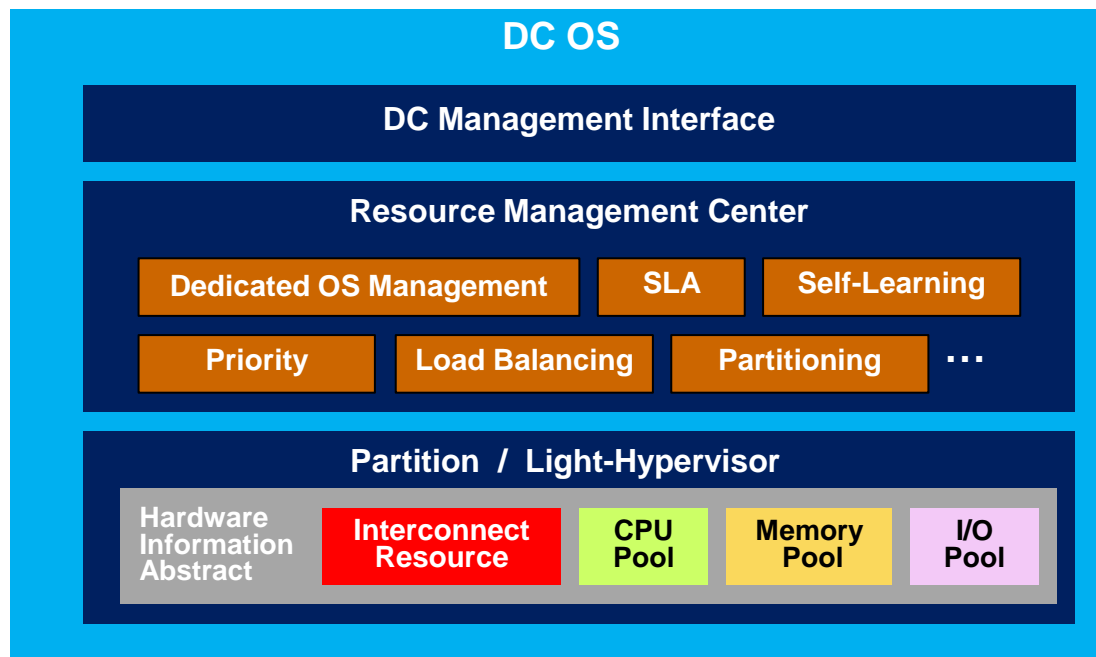
DC 3.0: HTC-DC

# HTC-DC Architecture

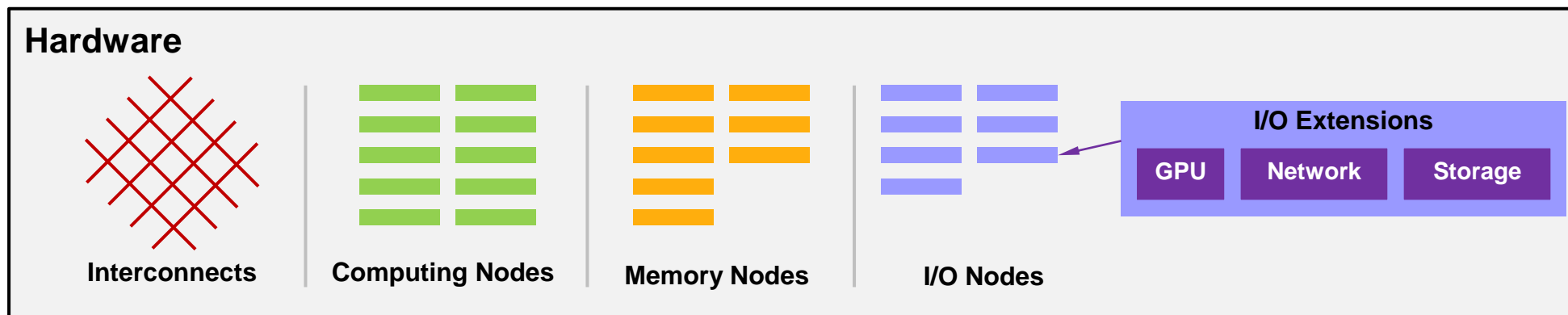
## Data Plane



## Management Plane

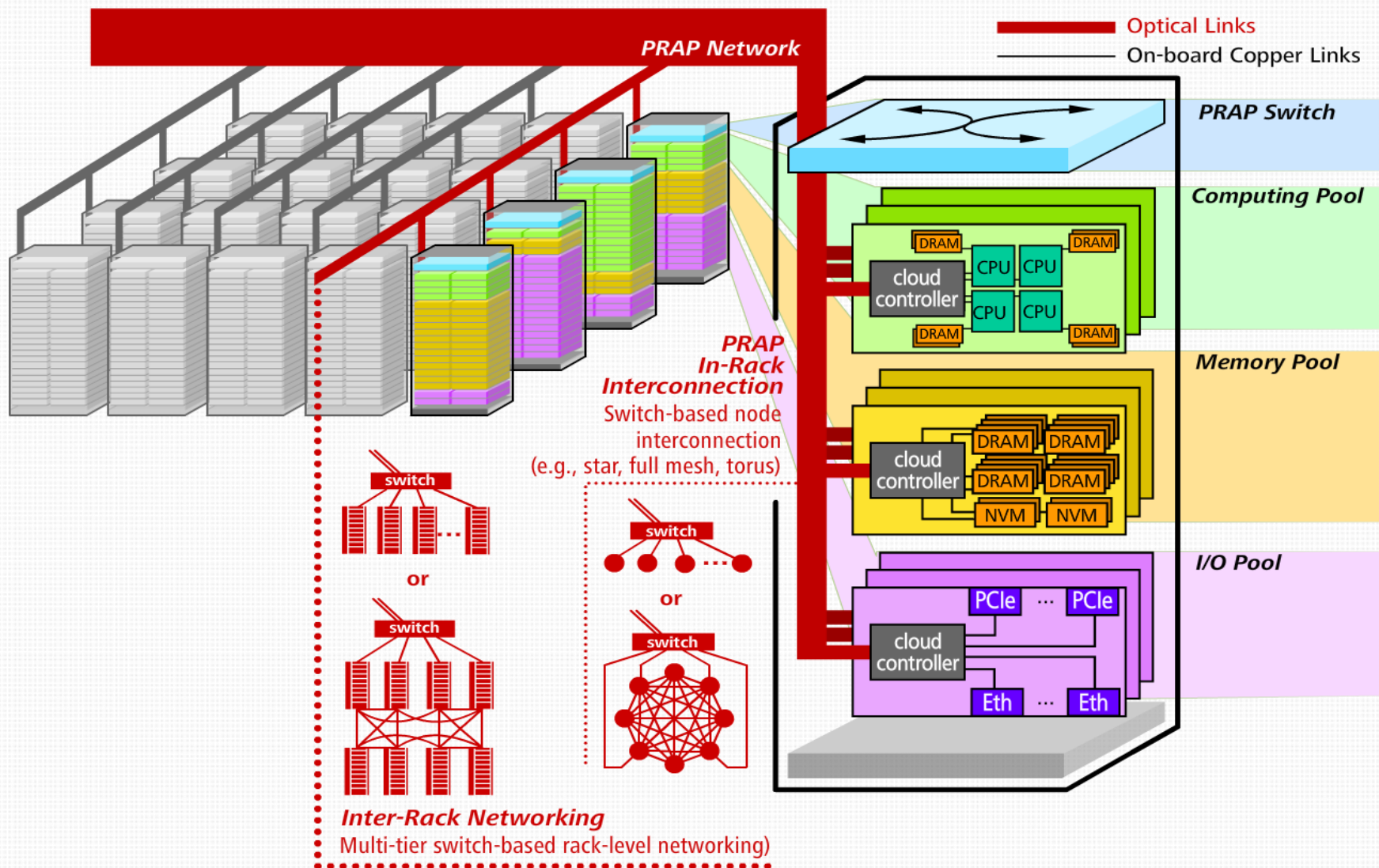


## Hardware

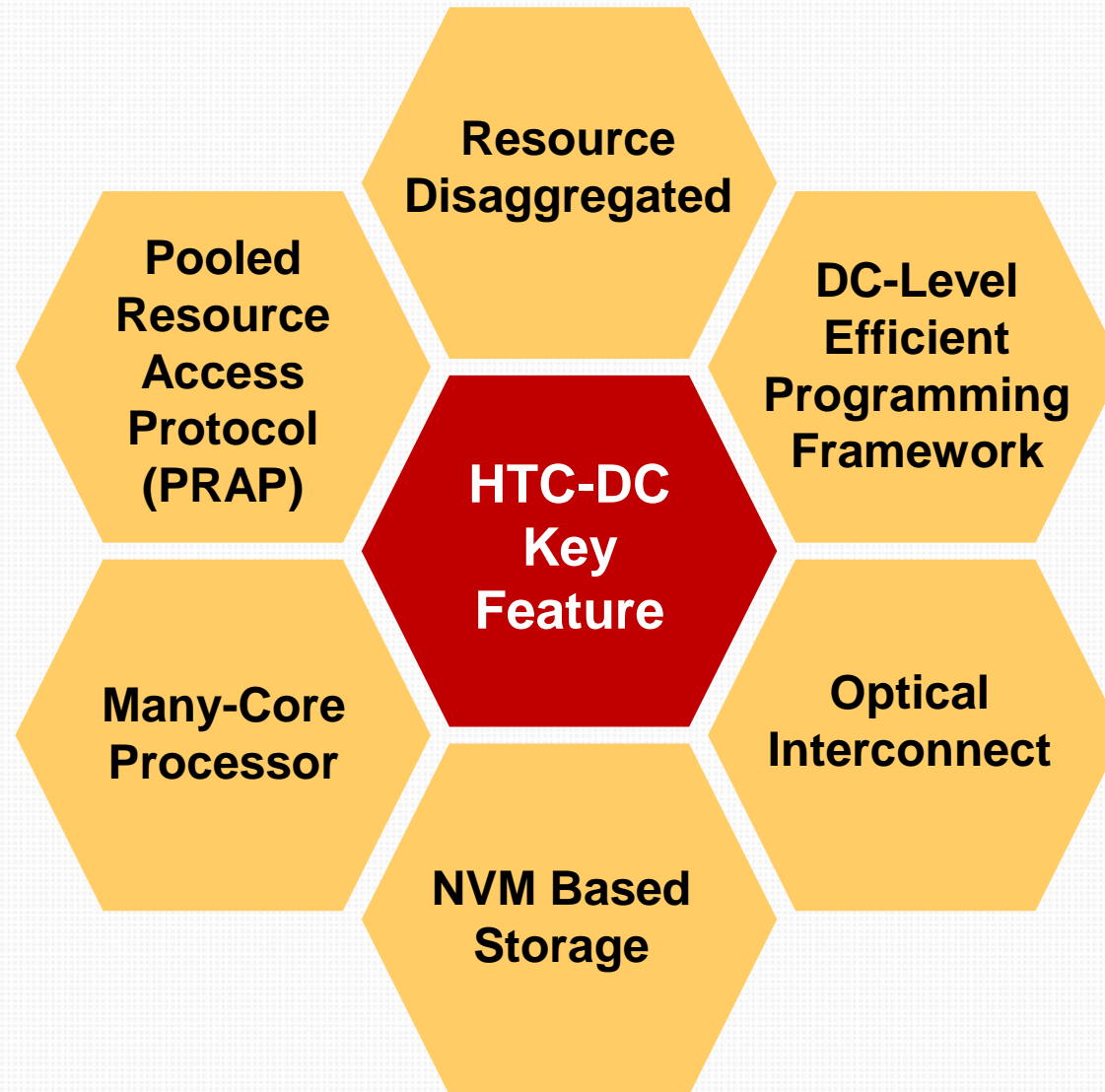




# Hardware Architecture of HTC-DC



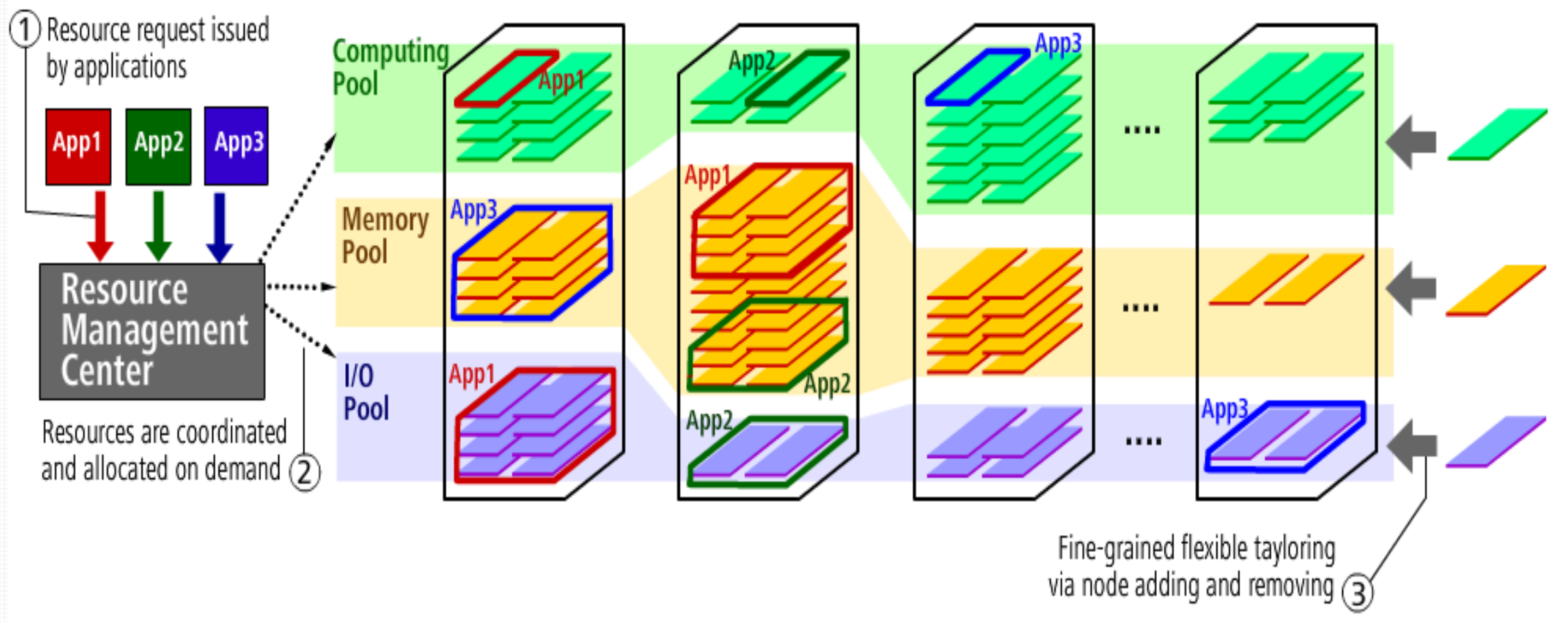
# HTC-DC Key Feature



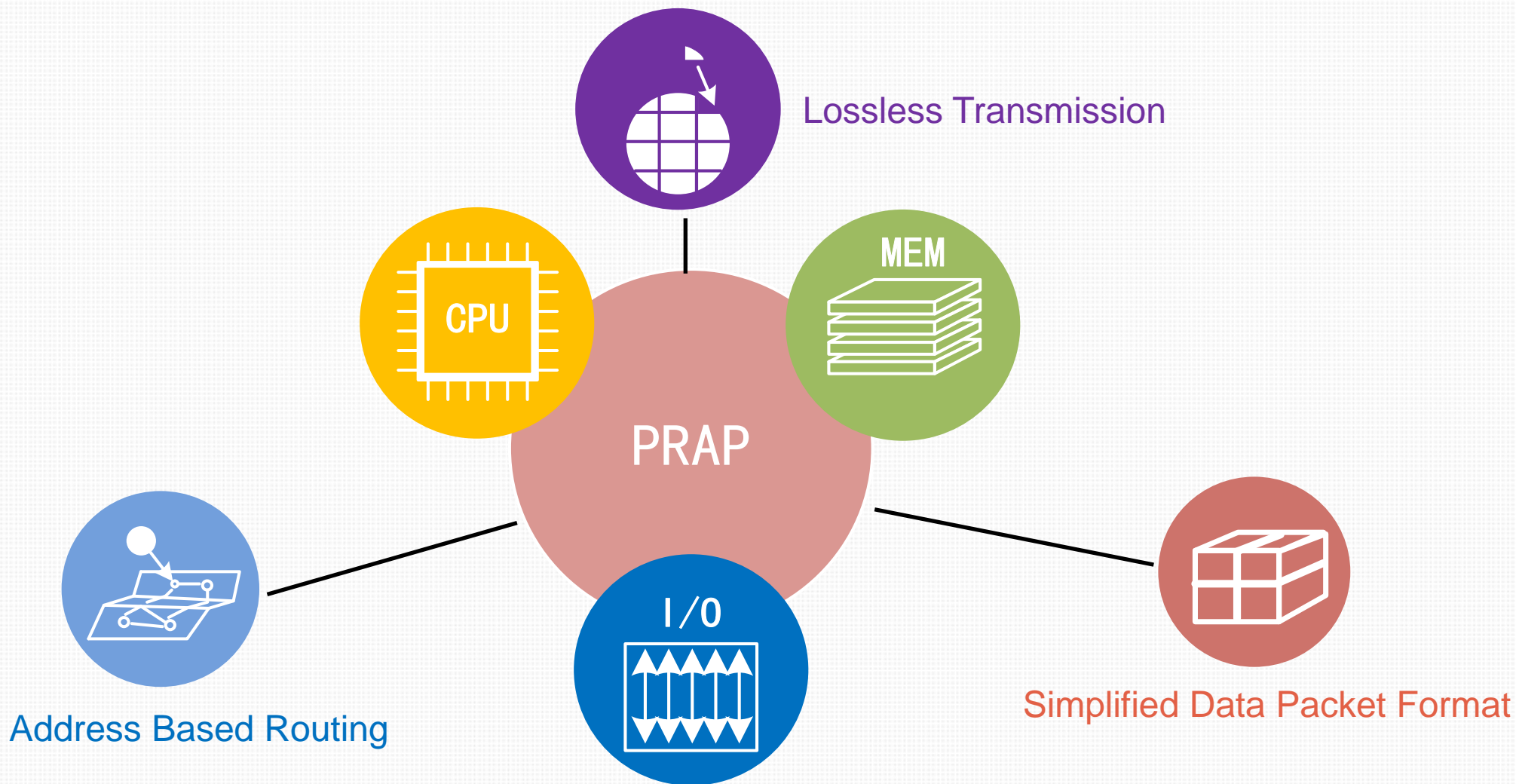


# Resource Disaggregated

## On-demand Resource Allocation Based on Disaggregation

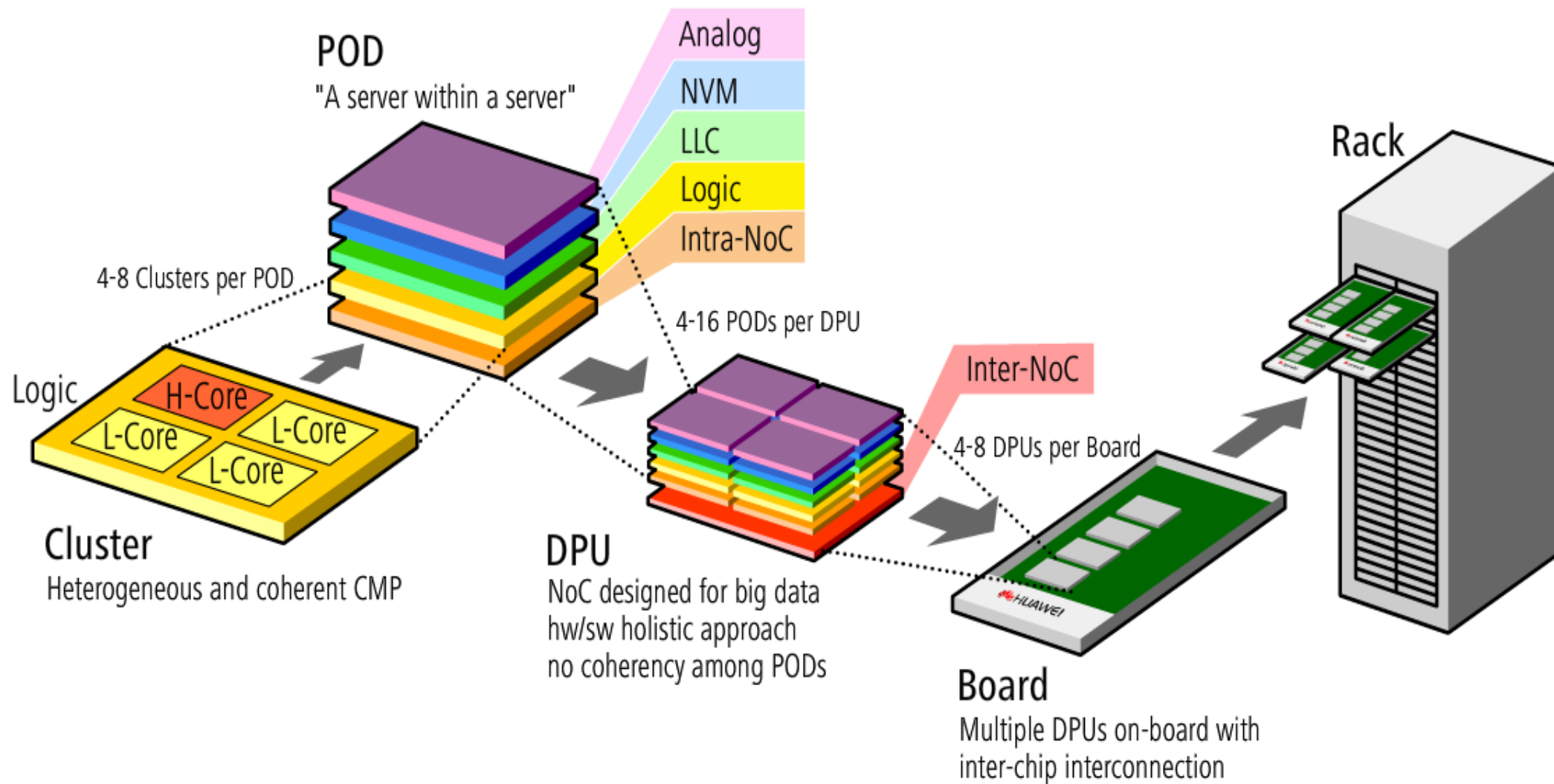


# Pooled Resource Access Protocol (PRAP)





# 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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