

# Delivering the next-generation data center to optimize business outcomes

Date: Sep. 19 (Wed.)

김한결 과장

HP

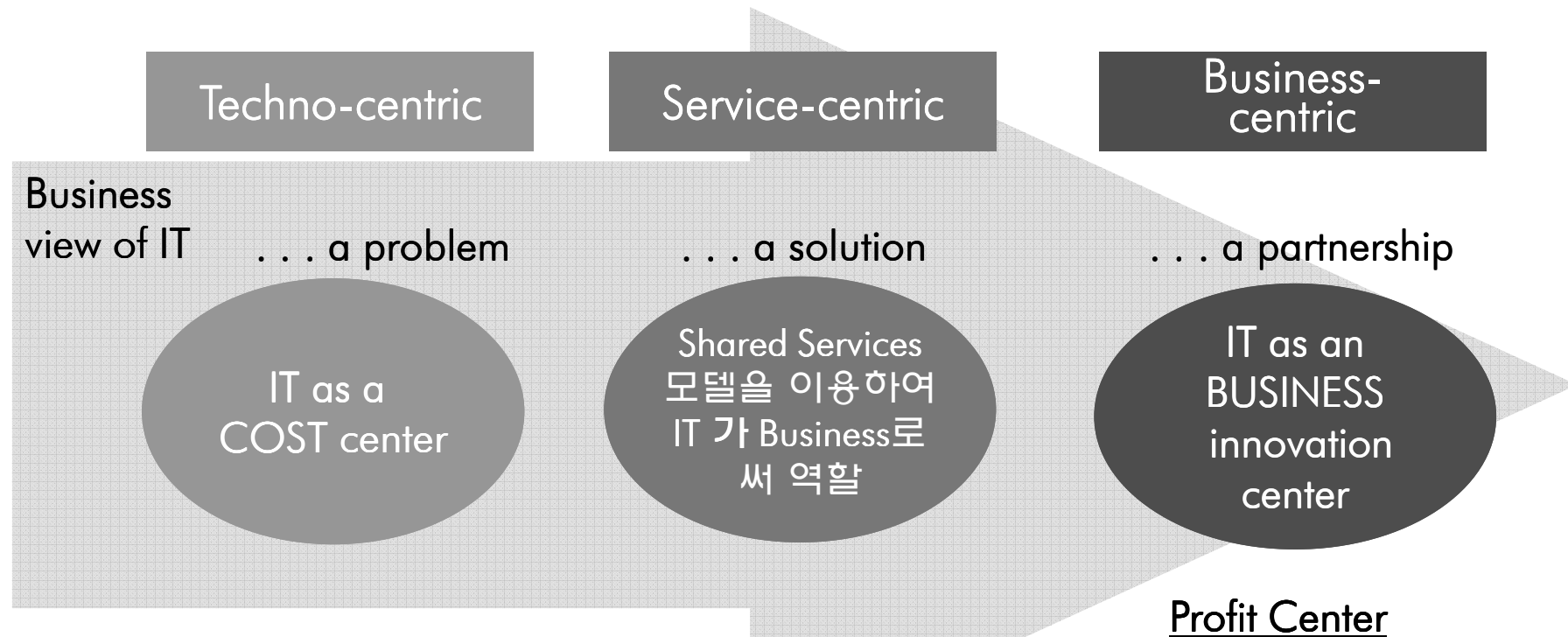


## HP Solution World 2007

IT transformation to BT



# Challenge of Datacenter



IT 조직은 기업에서 Business 조직과 같이 역할하며, Shared services의 창출, 판매, 증계, 제공을 통하여 높은 IT 투자 성과를 제공하는데 중점을 둠

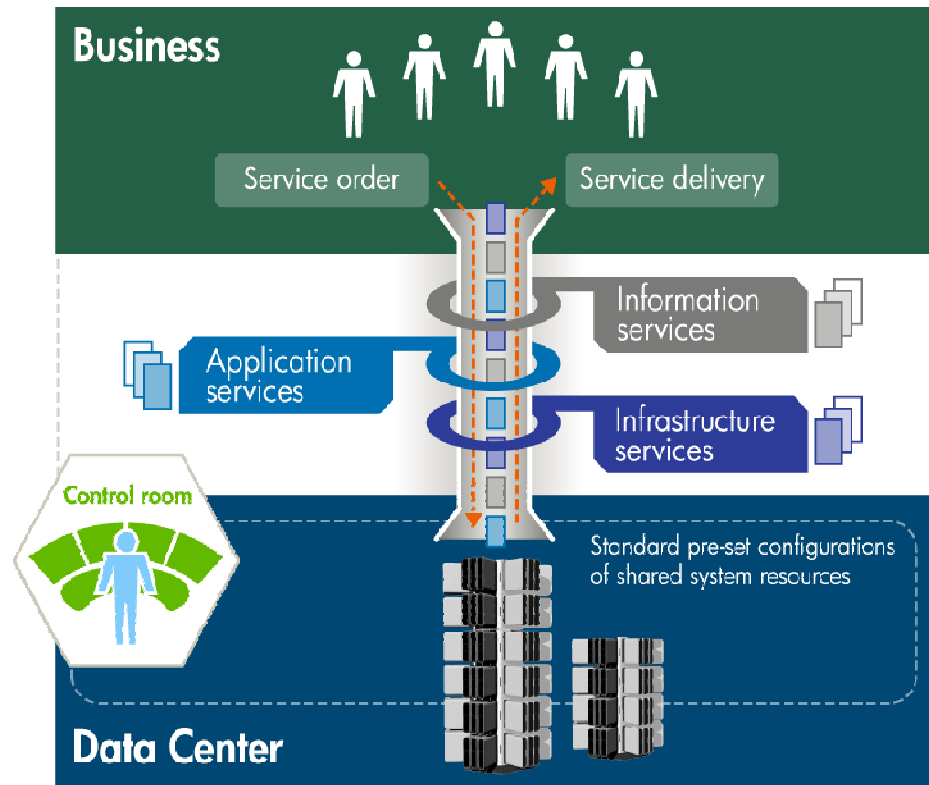
## Next Generation Datacenter

“연중무휴 리츠아웃(lights-out) 컴퓨팅 환경은 표준 시스템 확충방식 (building block), 자동화된 맞춤형(Modular) S/W, IT서비스를 위한 Supply Chain 구성에 달려 있다 “

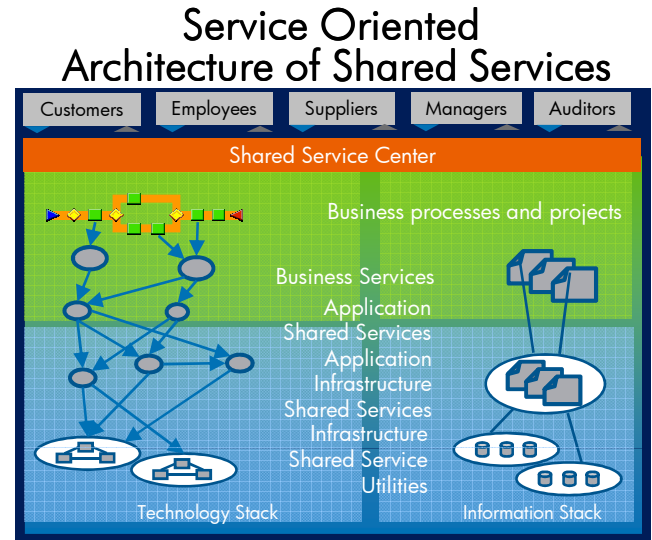
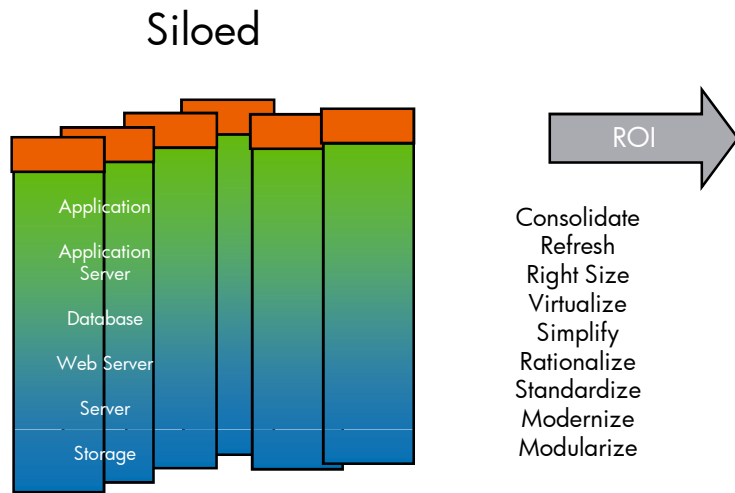
낮은 IT 운영 비용 (Cost)

높은 서비스 수준 (Quality)

변화에 대한 빠른 대응 (Speed)



# Shared Service Infrastructure



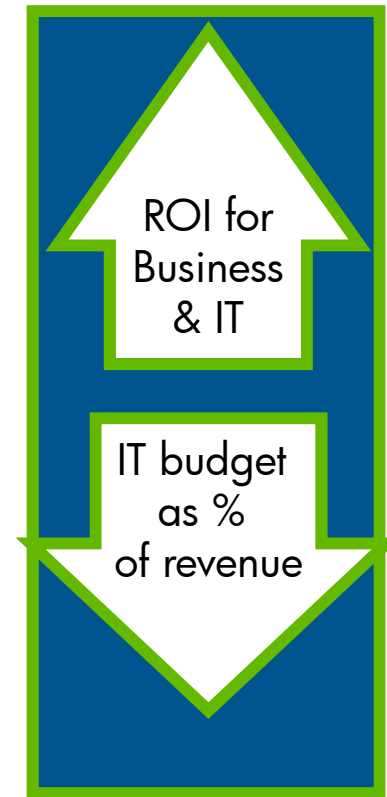
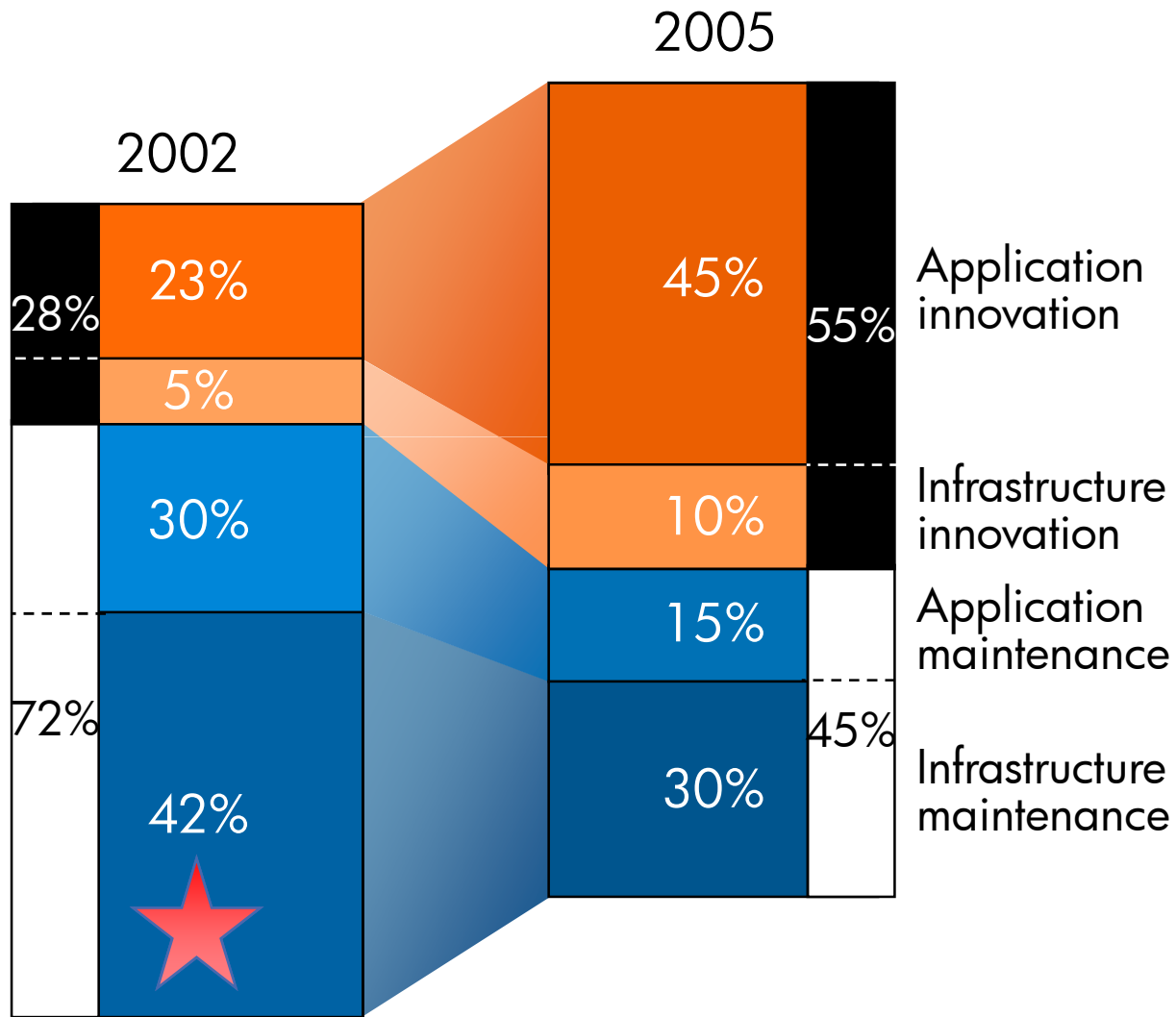
~ Today (서비스 단위의 시스템 배치)

- ü 과거에는 시스템의 도입 시 하나의 서비스에 하나의 시스템 형태로 도입 관리 됨에 따라, 관리의 효율성 측면을 중심으로 작업자의 작업 효율 및 동선에 고려하여 시스템을 배치
- ü 주요 시스템 배치 기준
  - 서비스별 배치 (작업자 중심의)
  - 플랫폼을 기준으로 한 배치

Today ~ Future (데이터센터 관리 중심의 시스템 배치)

- ü 서비스의 빠른 변화에 적응하여 안정적으로 지원할 수 있는 IT아키텍처의 필요성은 가상화, 파티셔닝 등 Utility Computing 기술을 통한 시스템 통합 가속화 시키고 있음
- ü 이에 따라 서비스와 Hardware와의 연관성이 느슨해지고 과거와 같은 서비스단위의 상면 배치가 불가능
- ü 최근에 이러한 IT의존도 증가 및 시스템 통합으로 데이터센터의 관리 품질과 안정성이 중요하게 대두

# Freeing IT investment for innovation



Source: HP-IT



# Consolidate Datacenter

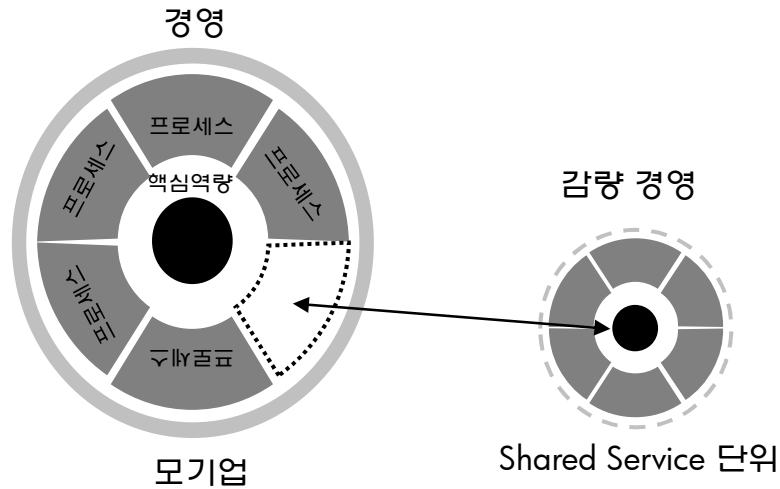
## How to make cost reduction?



Adaptive Infrastructure



# How to make the Profit Center - Shared Service



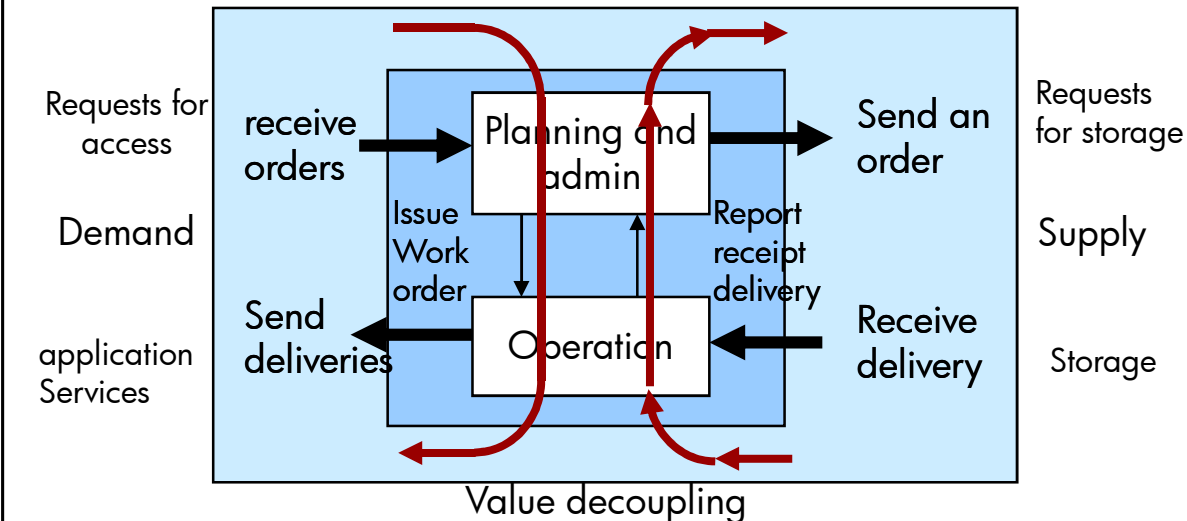
Shared Service는 기업의 기능 중 일부를 모기업과 별도의 경영구조를 갖는 반 자치사업 단위로 집중시켜 내부고객인 모기업의 능력향상, 가치 창출, 비용절감 및 서비스 개선을 도모하기 위한 일종의 협업 전략

모기업에 속한 부분 단위이기보다는 공개시장에서 경쟁적으로 이루어지는 비즈니스 형태와 유사할 수 있음.

**Bryan P. Bergeron**

“Essentials of Shared Services”

## Shared Infrastructure 의 Value chain 흐름



§SLA

§Charge back

§Utility Computing

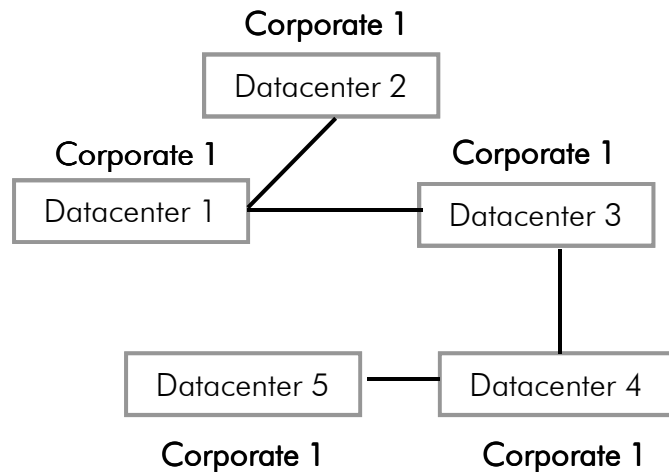


# How to make the Profit Center - Consolidated Datacenter

전산센터는 기업내의 비즈니스를 기준으로 한 분산형 데이터센터 구조에서 Shared Service 모델에 적합한 중앙 집중적 데이터센터 체계로 변화 해나가고 있습니다.

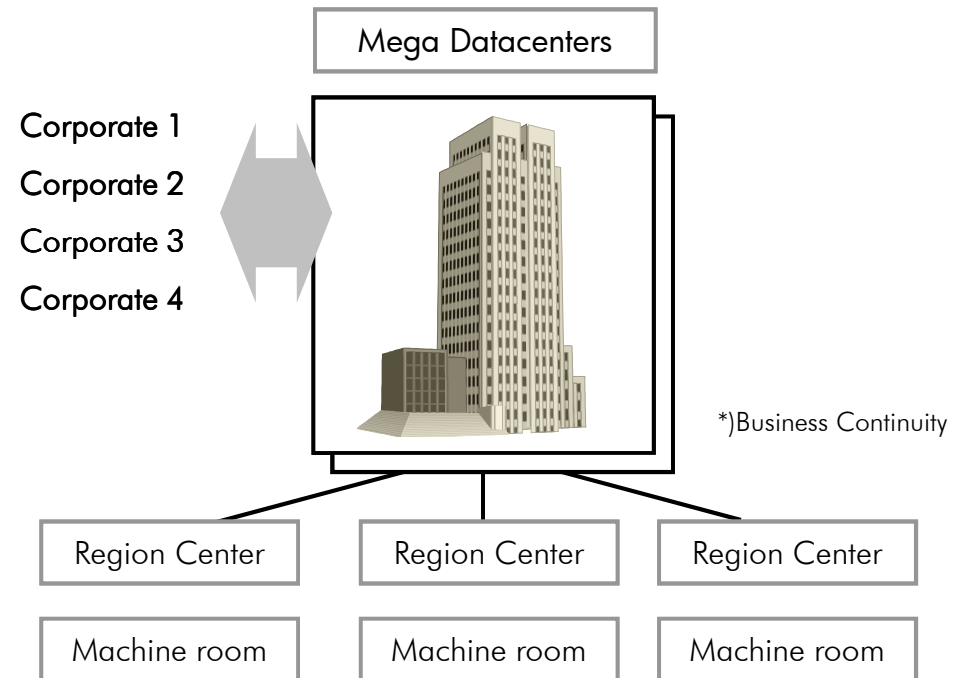
## **AS-IS** 분산형 데이터센터

개별 비즈니스 중심의 지역별 전산센터



## **TO-BE** 비즈니스 공유의 전산센터

중앙집중적 데이터센터

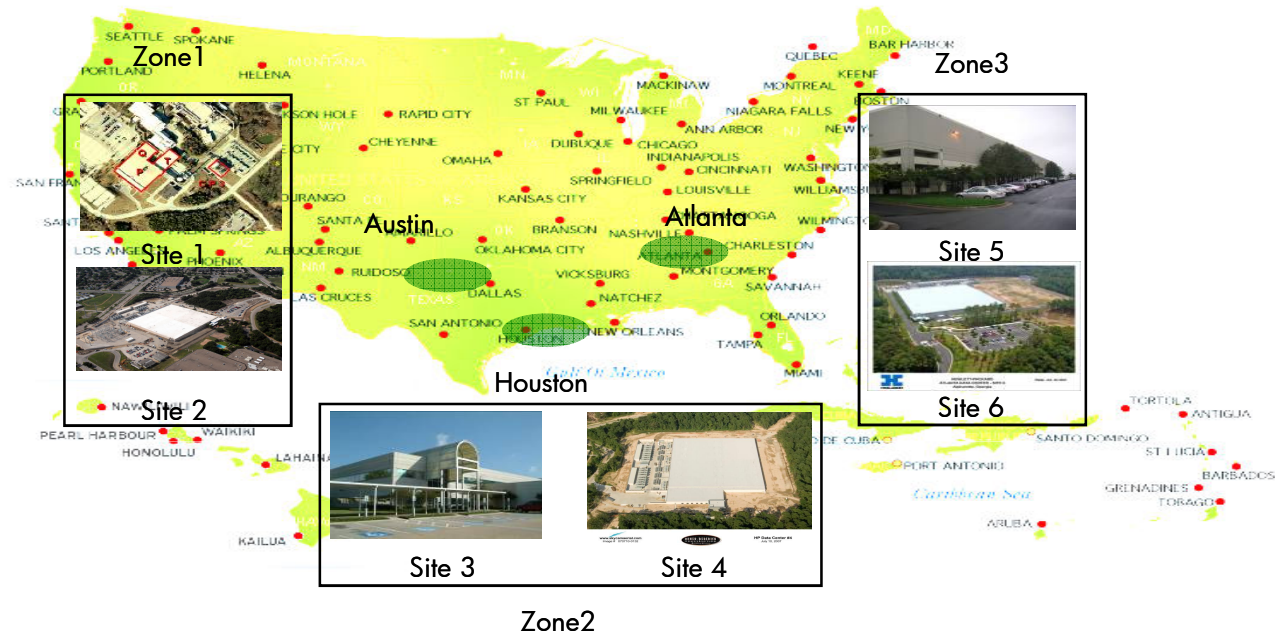




## 제 2기 Global Datacenters - Hewlett Packard IT

Challenge	Solution	Target State
<ul style="list-style-type: none"> <li>§ 너무 많은 프로젝트가 동시에 진행됨에 따라 수행 속도의 향상이 요구됨</li> <li>§ IT 자원이 50 여개국 100개의 사이트 배치가 되어서 통합이 요구가 됨</li> <li>§ 기업 인원 및 리소스가 기본 활동에 너무 편중되어 기업 혁신 프로젝트의 진행 의 어려움 발생</li> <li>§ 기업 비즈니스 정보가 100 여개가 넘는 데이터 마트에 산재 통합 필요</li> <li>§ IT 환경의 거대화 및 복잡도 증가에 따른 비용 증가</li> </ul>	<ul style="list-style-type: none"> <li>§ 다섯가지의 전략을 기반으로 변화를 수행하였습니다.               <ul style="list-style-type: none"> <li>- 사업의 포트폴리오 효율화</li> <li>- IT업무 환경 효율화</li> <li>- 글로벌 데이터센터</li> <li>- 전사적 데이터 웨어하우스</li> <li>- World-class IT</li> </ul> </li> </ul>	<p><b>Simplicity</b></p> <ul style="list-style-type: none"> <li>§ 비즈니스 중요도를 기반으로 한 IT 프로젝트 중요도 재정립</li> <li>§ 핵심 비즈니스 어플리케이션 으로 표준화 및 불필요 요소 제거</li> </ul> <p><b>Efficiency</b></p> <ul style="list-style-type: none"> <li>§ 중앙집중적 IT 조직 및 비용구조 마련 (Shared Service)</li> <li>§ IT 인력에 대한 Core Site로 집중화를 통한 업무 향상성 증대</li> </ul> <p><b>Agility</b></p> <ul style="list-style-type: none"> <li>§ 업무 역량의 재할당: 80% 혁신, 20% 유지</li> <li>§ 통합 엔터프라이즈 DW 구축</li> </ul> <p><b>Value – 비용 절감:</b></p> <ul style="list-style-type: none"> <li>§ 6개의 글로벌 데이터센터 구축</li> <li>§ 연간 1조의 운영비용 절감</li> <li>§ 대외 홍보 위한 HP 제품 및 전산센터 통합 서비스 모델 마련</li> </ul>

# HP Global Datacenters



- ü 3 Zones supporting HP's Global Applications (Austin, Houston, Atlanta)
- ü Total white space ~410,000 sq ft (서버 룸 공간 기준 약 1,1000평)
- ü Within each zone: 2 sites within 10-25 mile radius of each other where feasible
- ü Each site designed for High Availability, Disaster Recovery and Business Continuity

# HP DCC Considerations & Scope

## Consolidated Infrastructure

- Secure facilities
- Wide area Network
- Redesign of DRP & BCP
- Shared infrastructure
- Site Location
- Building & Physical Environment
- Consolidated service helpdesk
- How many Datacenter

## Moving Equipment

- Physically consolidated datacenter
- Remained equipment & resource
- Down time

## Investment plan

- Expected budget
- Expected ROI (Return on Investment)
- ROI Measurement system

## IT governance model

- Ensure business alignment
- Proper balance of cost, service levels, risk and agility for the business
- Must support standards and shared infrastructure

## IT processes

- Many processes will need to change because of shared infrastructure, and to maintain the efficiencies from consolidation

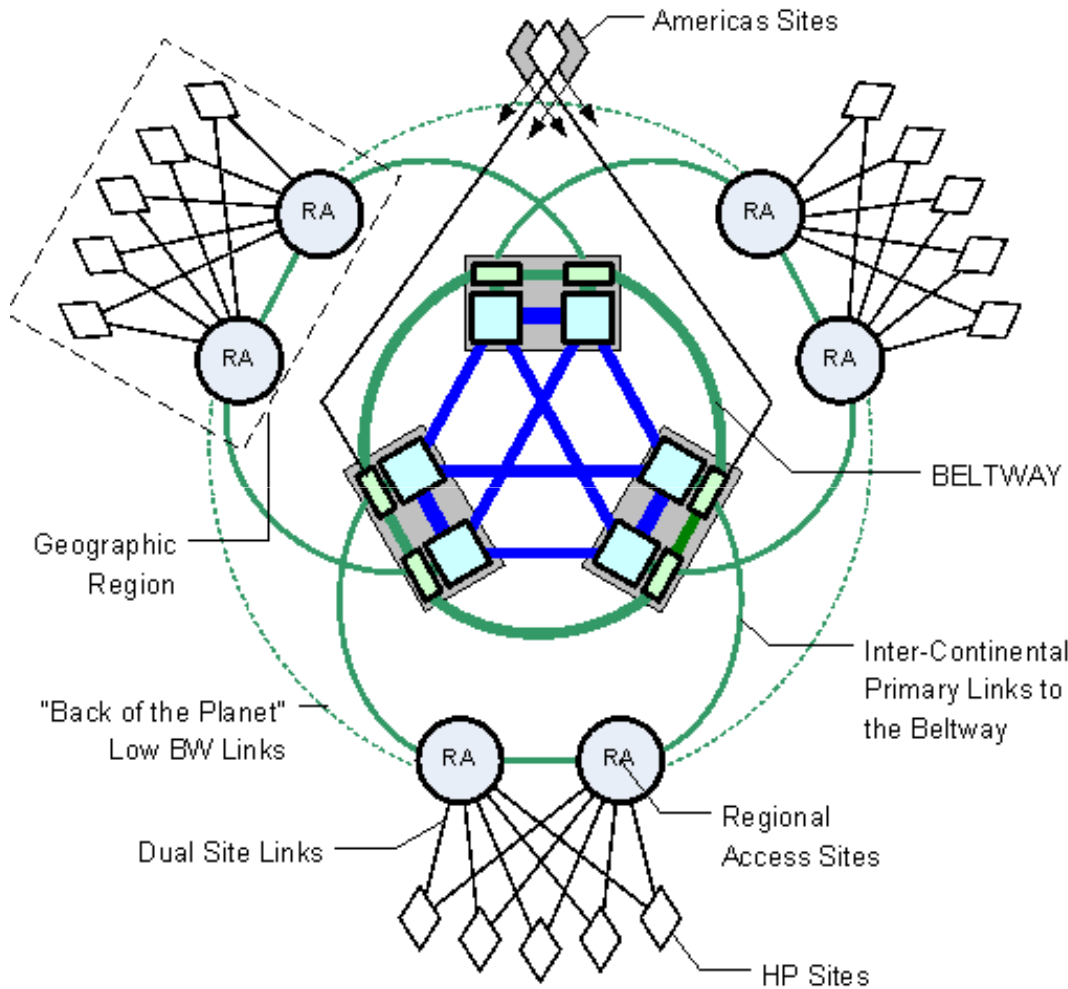
## IT organization

- Reorganization may be warranted given other changes, especially with collocation
- HR Planning (retention, reduction etc)

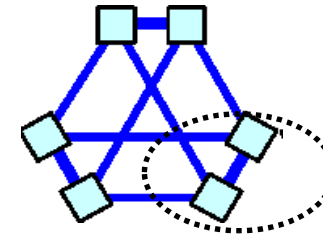
## Human impact

- Consolidation means change for your staff
- May mean role change, retooling, relocation or redeployment
- Retention and buy-in may be factored

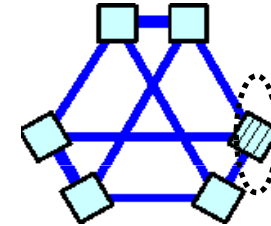
# Space Design - Modular Datacenter Concept



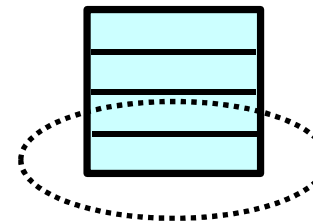
Facility Availability : Tier 3 +



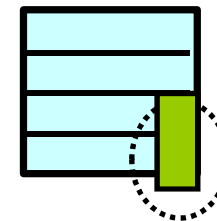
Zone



Building



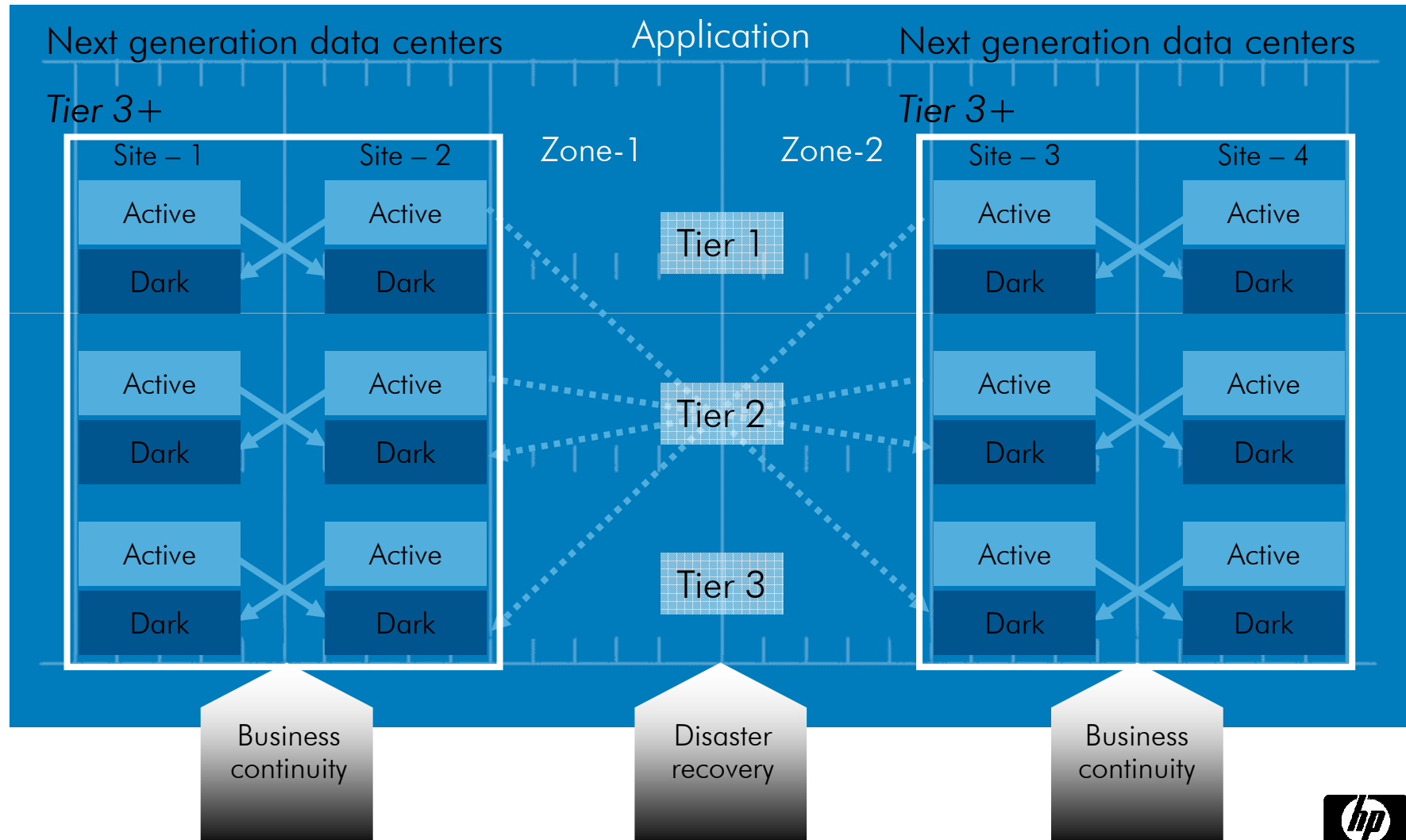
Module



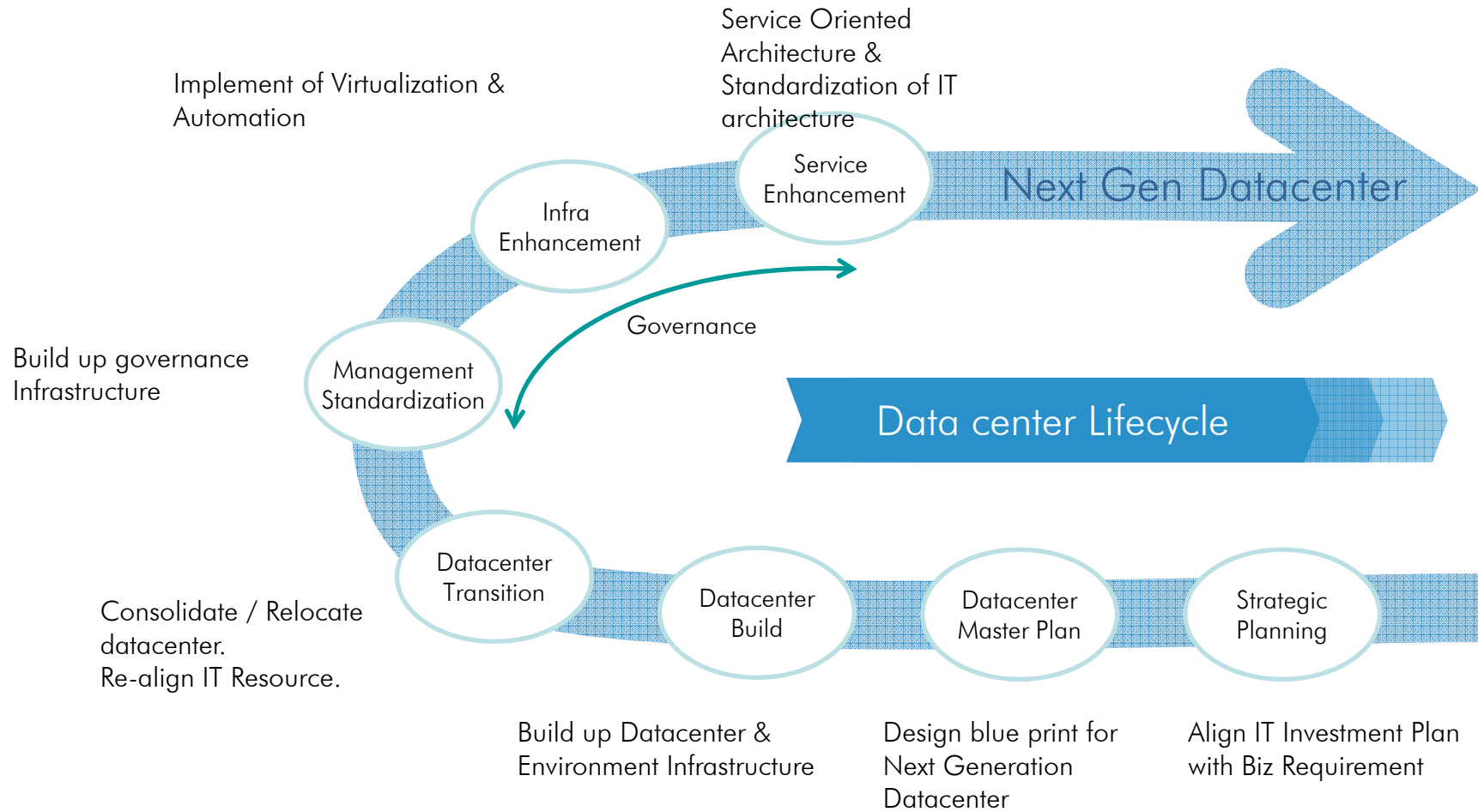
Pod

# Business Continuity – Global Datacenters Business Continuity

## Global Data Centers

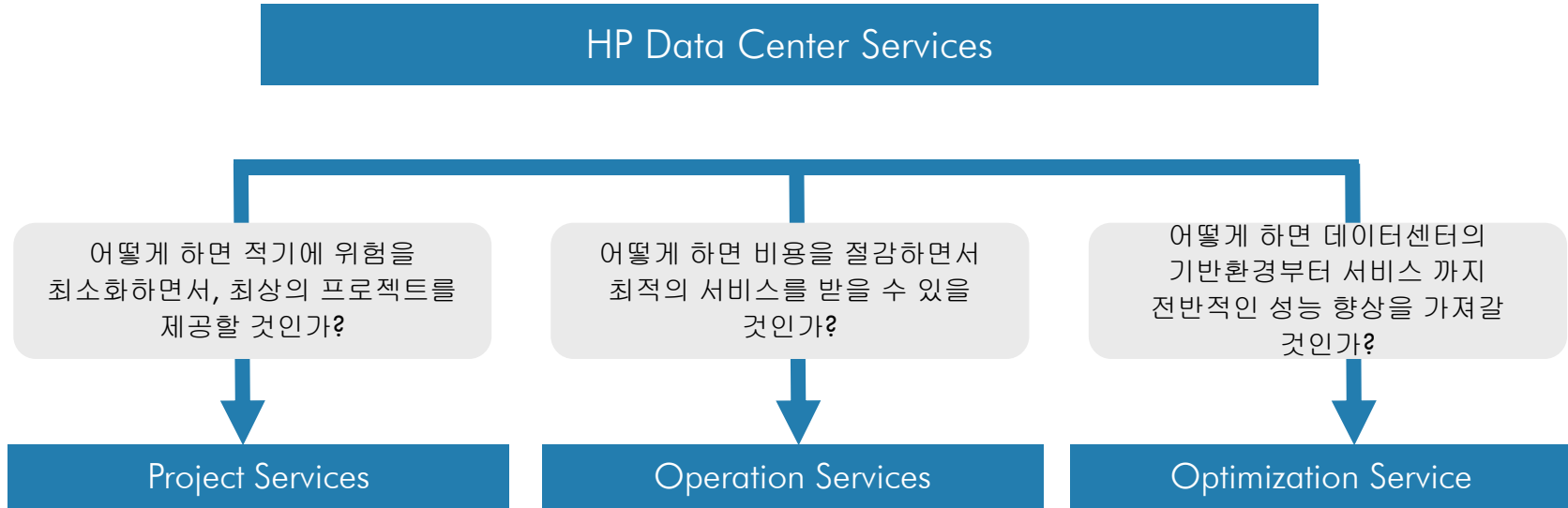


# Strategy - HP Datacenter Lifecycle Service





# Service Offering - Datacenter Service



- §Migration Service
- §Site Planning Service
- §Relocation Service
- §Deployment Service
- §Project Management Service
  - üConceptual Engineering Service
  - üInfrastructure Construction Service
  - üHP Solution Implementation Service

- §Server Operation Service
- §Storage Operation Service
- §Software Operation Service
- §Network Operation Service
- §Resource and Technical assistance

- §ITSM assessment & design service
- §IT Security and Risk assessment & design service
- §Datacenter assessment & design service
- §Power & Cooling Service
- §Infrastructure optimization assessment & implementation service

# Datacenter Infrastructure

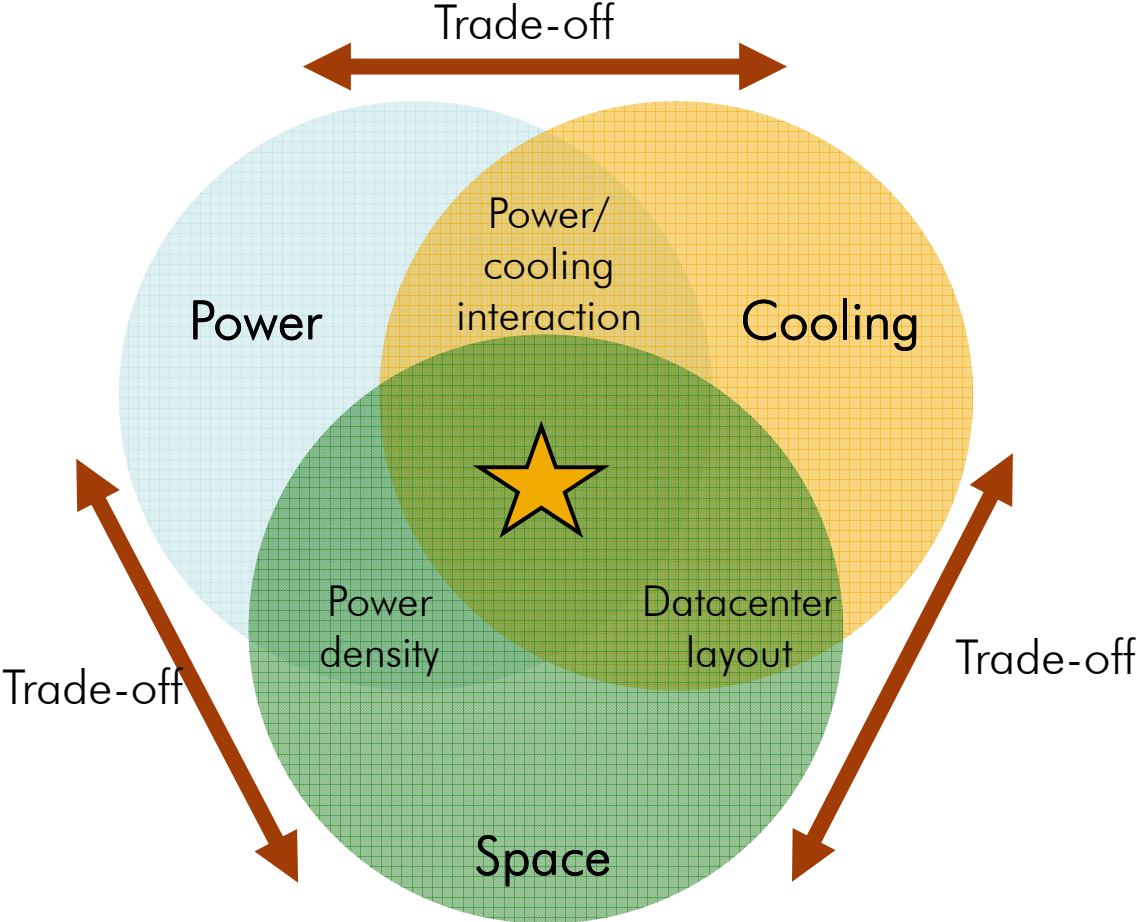
## How to make more energy efficiency?



Adaptive Infrastructure – Power & Cooling Key Enabler



# Datacenter Facility Key Factors

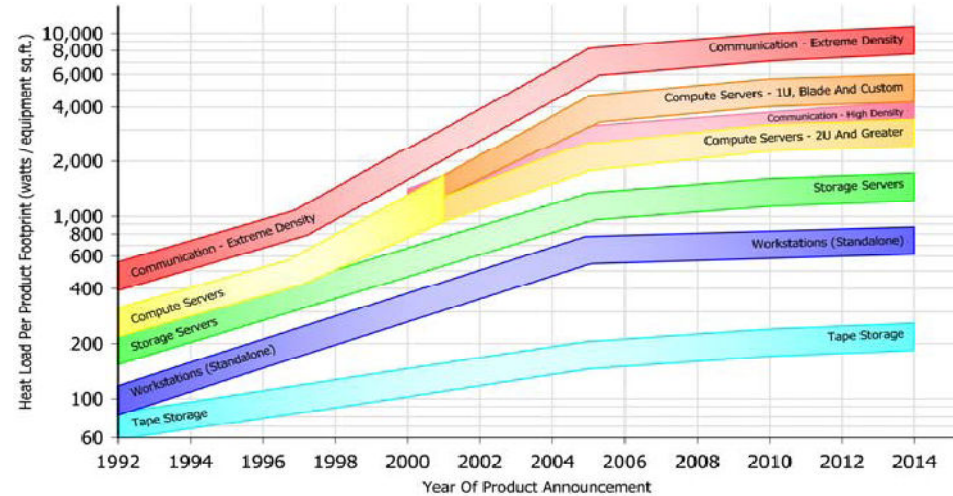


# IT System power densities Trend

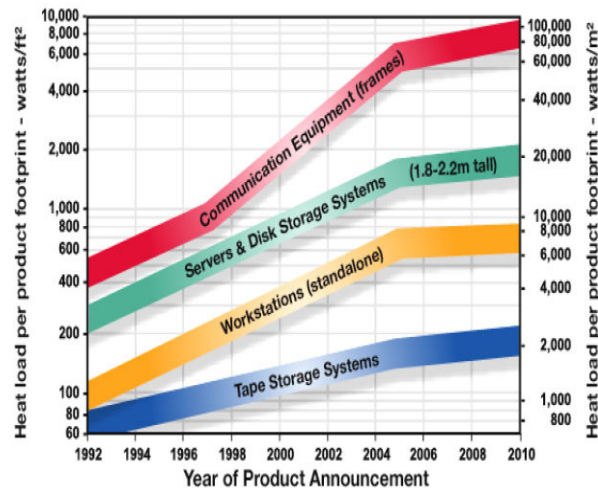
§ System Product Lifecycle : 3~5 years

§ Datacenter Product Lifecycle : 10 ~ 25 years

신규 데이터센터 구축 시 시스템의 미래 추이를 고려하여 설계 되어야 함.



Source: Datacom Equipment Power Trends and Cooling Applications, ASHRAE, 2005, <http://www.ashrae.org>



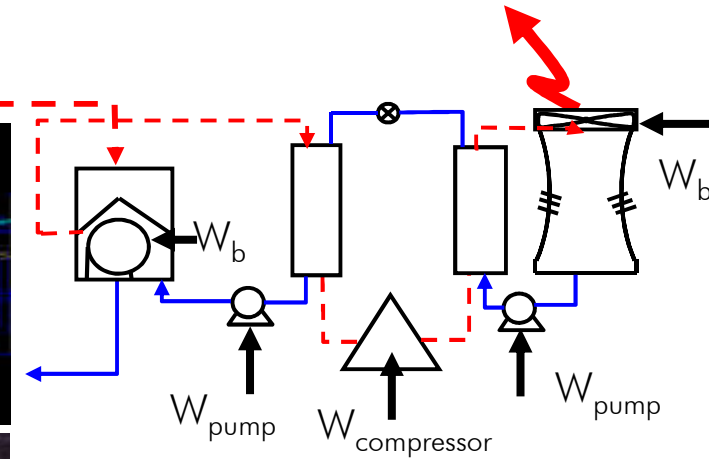
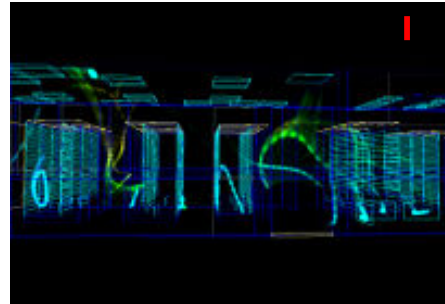
Source : Data Equipment Power Trend Charts : TUI, 2000

Ver 1.0 (2000) TUI	KWatt/m <sup>2</sup>		New Version (2004) ASHARE	KWatt/m <sup>2</sup>	
	2000	2010		2000	2010
Server Disk Storage System	10	23	• Compute Servers – 1U Blade and Custom	15.4	64.9
			• Computer Server – 2U and Greater		35.2
			• Storage		7.7
Communication Equipment	20	100	• Communication – High Density	15.4	42.9
			• Communication – Extreme Density		26.4

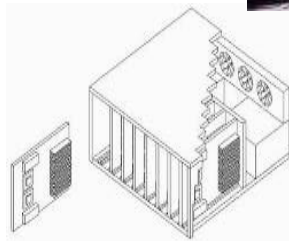


# Required Holistic Management

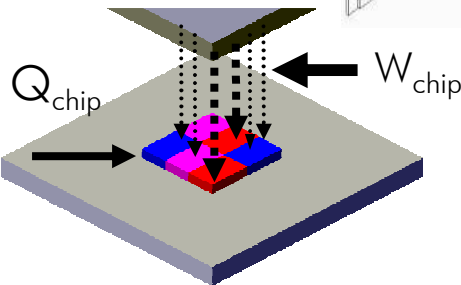
Holistic View from the Chip Core to the Cooling Tower



$Q_{system}$  →



*data center is the computer*  
*IT + Facility View*



$$COP = \frac{\text{Total Heat Dissipation}}{(\text{Flow Work} + \text{Thermodynamic Work}) \text{ of Cooling system}} = \frac{\text{Heat Extracted by Air Conditioners}}{\text{Net Work Input}}$$

Patel et. al, Energy Flow in the Information Technology Stack: Coefficient of Performance of the Ensemble and its Impact on TCO  
<http://www.hpl.hp.com/techreports/2006/HPL-2006-55.html>

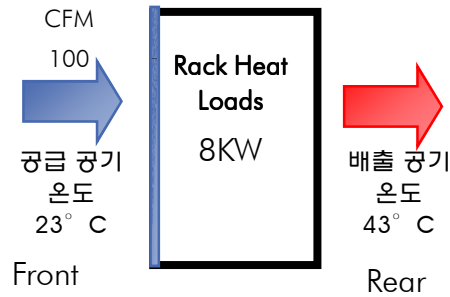




# Low Efficiency in Cooling Environment

Vertical Under Floor

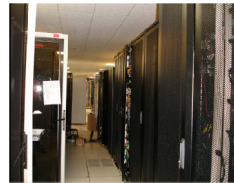
Ideal Case



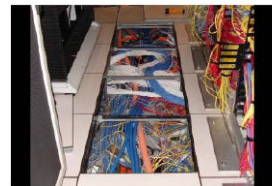
상기 조건은 시스템의 CFM / 발열량에 따라 변화할 수 있습니다.



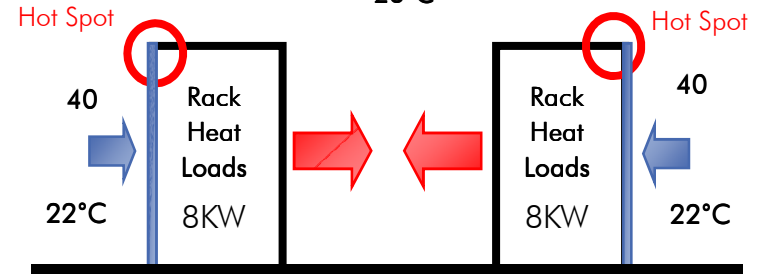
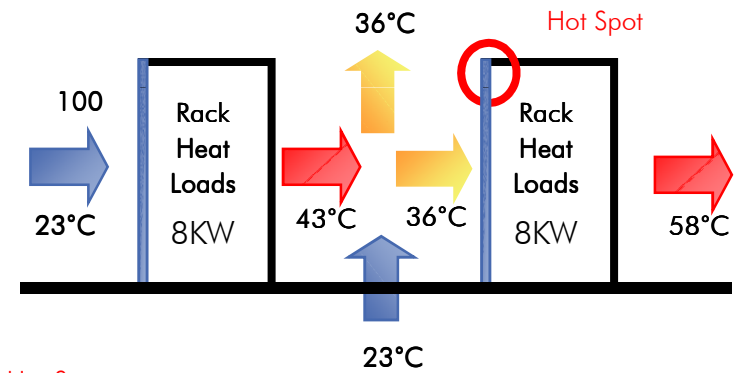
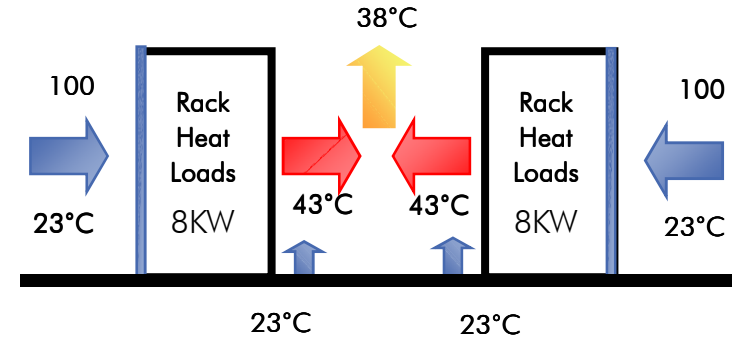
- §정리되지 않은 케이블
- §블랭크 판별 미사용
- §이중마루 임의 절단



§F-R-F-R 형태의 잘못된 랙 배치

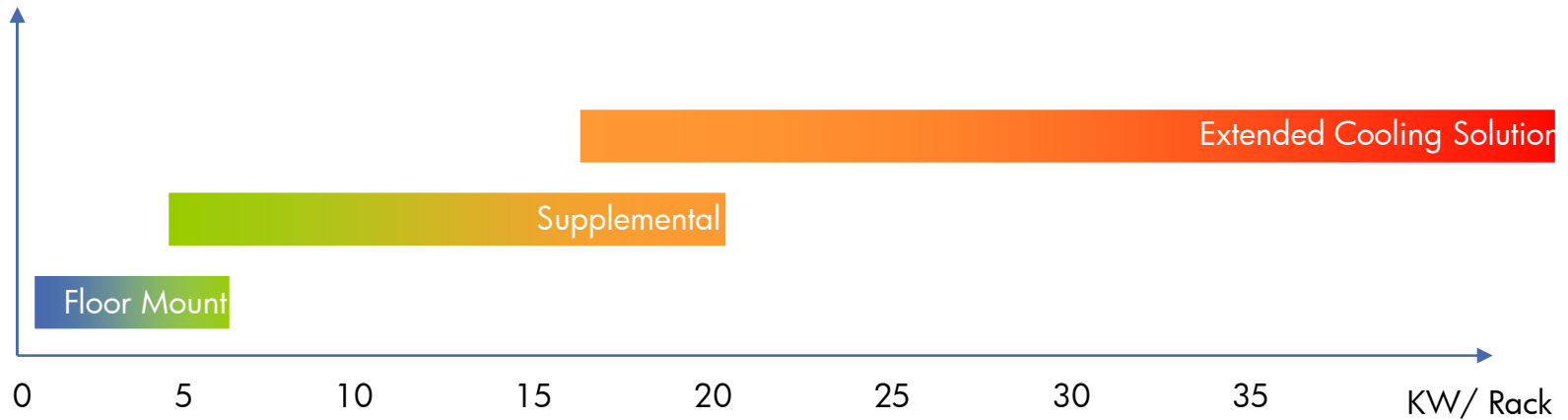


§이중마루 하부의 케이블 적체

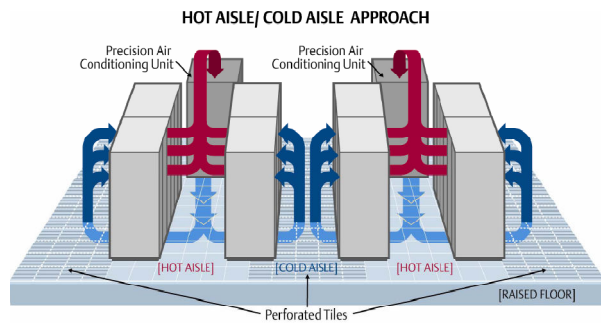




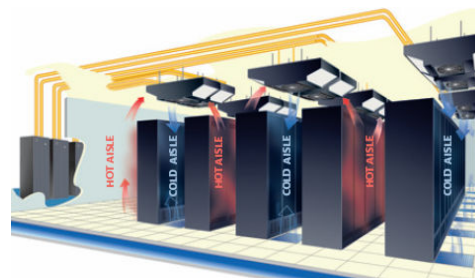
# Best Practice Cooling Environment – VUF Based



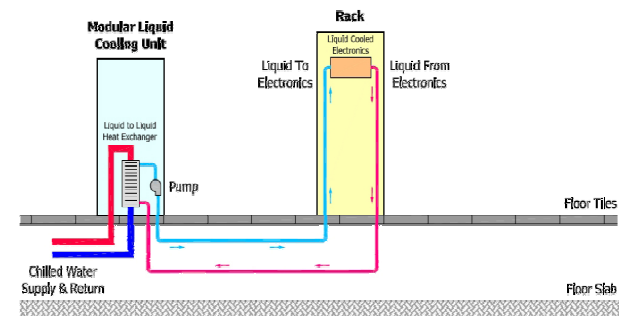
**Floor Mount**  
Vertical Under Floor Best Practice



**Supplemental**  
VUF with Supplemental



**Extended Cooling Solution**  
Chiller with High-density Cooling



# HP Datacenter Strategy

## Sustainable computing is the goal

Industrialization of IT

- § Data centers as building blocks
- § It's about profit per watt...
- § Data center energy will be a public policy issue

Integrated Infrastructure

- § Convergence & automation

Value migration: HW to SW

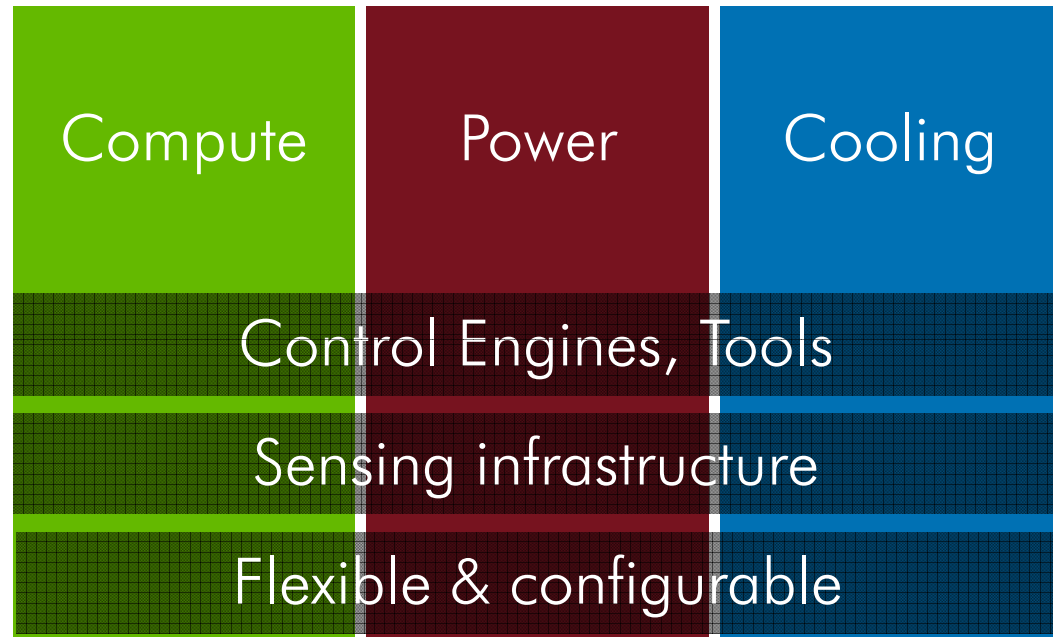
- § Control engines & tools (policies)

Global workforce, global IT

- § Sustainability

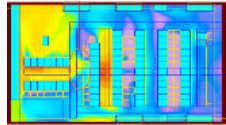
Energy efficiency & de-materialization

- § Industry leads or government regulates



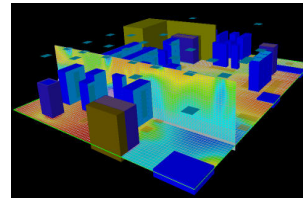
“The data center is the computer”

# HP Power and Cooling research History in the data center



1996  
Computational Fluid Dynamics (CFD) applied to internal data centers

2001  
Led the drafting of the "Thermal Guidelines for Data Processing Environments" and is one of the primary contributors.

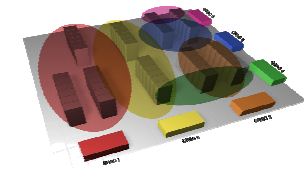


2003  
Smart Cooling Thermal Assessments introduced



2006  
C-Class Blades introducing HP Thermal Logic for improved efficiency

2007  
Thermal Zone Mapping introduced



1999-2000  
HP embraced the Uptime Institute's "Fault Tolerant Power Compliance Specification" for servers.

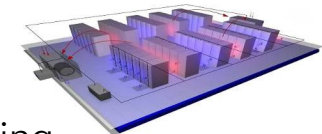
2002  
First to introduce data center metrics which analyzed the correlation between rack-level recirculation of hot air and the short-circuiting of cool air at air-conditioner inlets.

2004  
Introduction of Server power management technologies such as power regulator



2006  
Modular Cooling System (MCS)  
Liquid cooled Rack

2006  
Dynamic Smart Cooling announced



# HP driving industry efficiency metrics - PUE

## Broad industry adoption

### Server efficiency - April 2006<sup>1</sup>

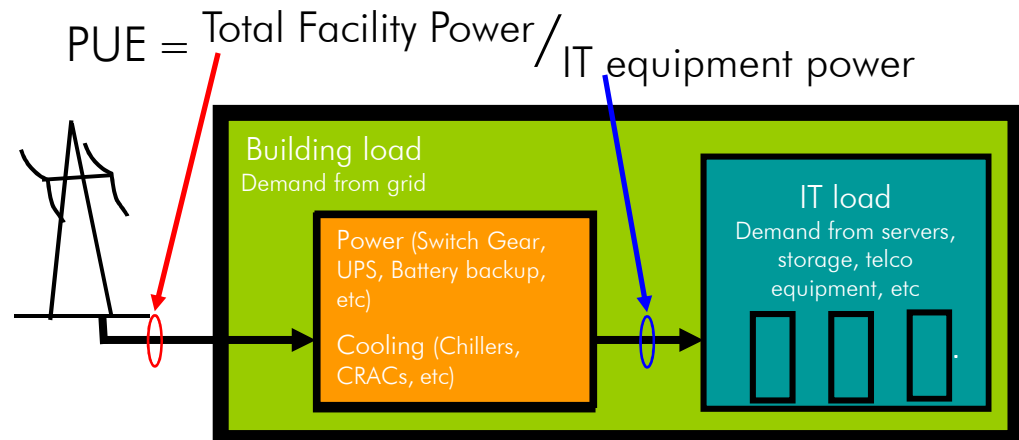
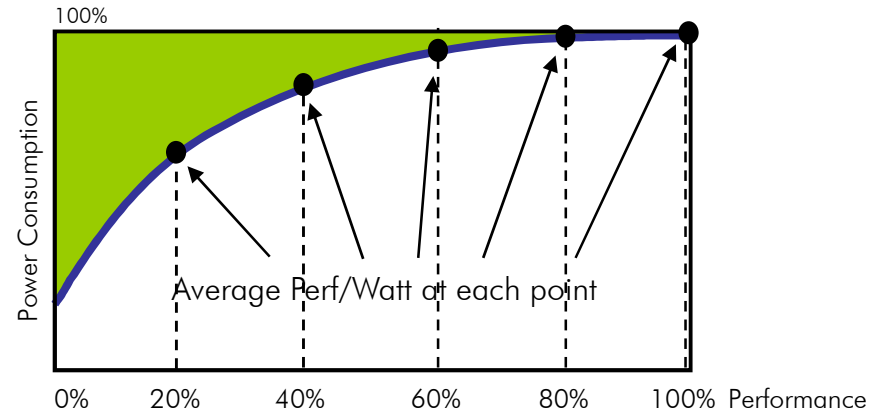
Industry used this work as foundation for:

- Energy Star Paper (HP a primary)<sup>2</sup>
- SPEC Power Benchmark (HP Chairs Committee)

### Data center efficiency – April 2006<sup>3</sup>

Power Usage Effectiveness ratio (PUE) has been adopted by:

- ASHRAE (HP is a committee Founder)
- Green Grid (HP is member of the BoD and Metrics Work Group Chair)



Sources: <sup>1</sup> [http://thegreengrid.org/pdf/Efficiency\\_slides\\_for\\_General\\_Distribution\\_Final.pdf](http://thegreengrid.org/pdf/Efficiency_slides_for_General_Distribution_Final.pdf)

<sup>2</sup> <http://www.energystar.gov/ia/products/downloads/Finalserverenergyprotocol-v1.pdf>

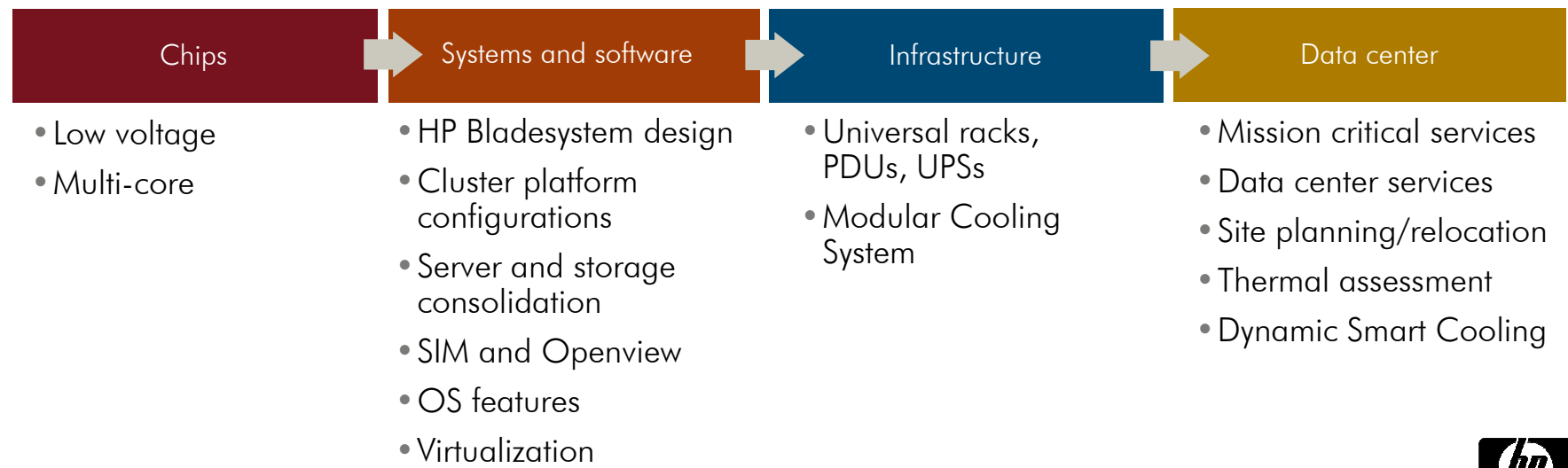
<sup>3</sup>C. Malone, C. Belady, "Metrics to characterize Data Center & IT Equipment Energy Use", Proceedings of 2006 Digital Power Forum, Richardson, TX (September 2006)

# HP leadership through holistic approach

Holistic offering (chips to data center)

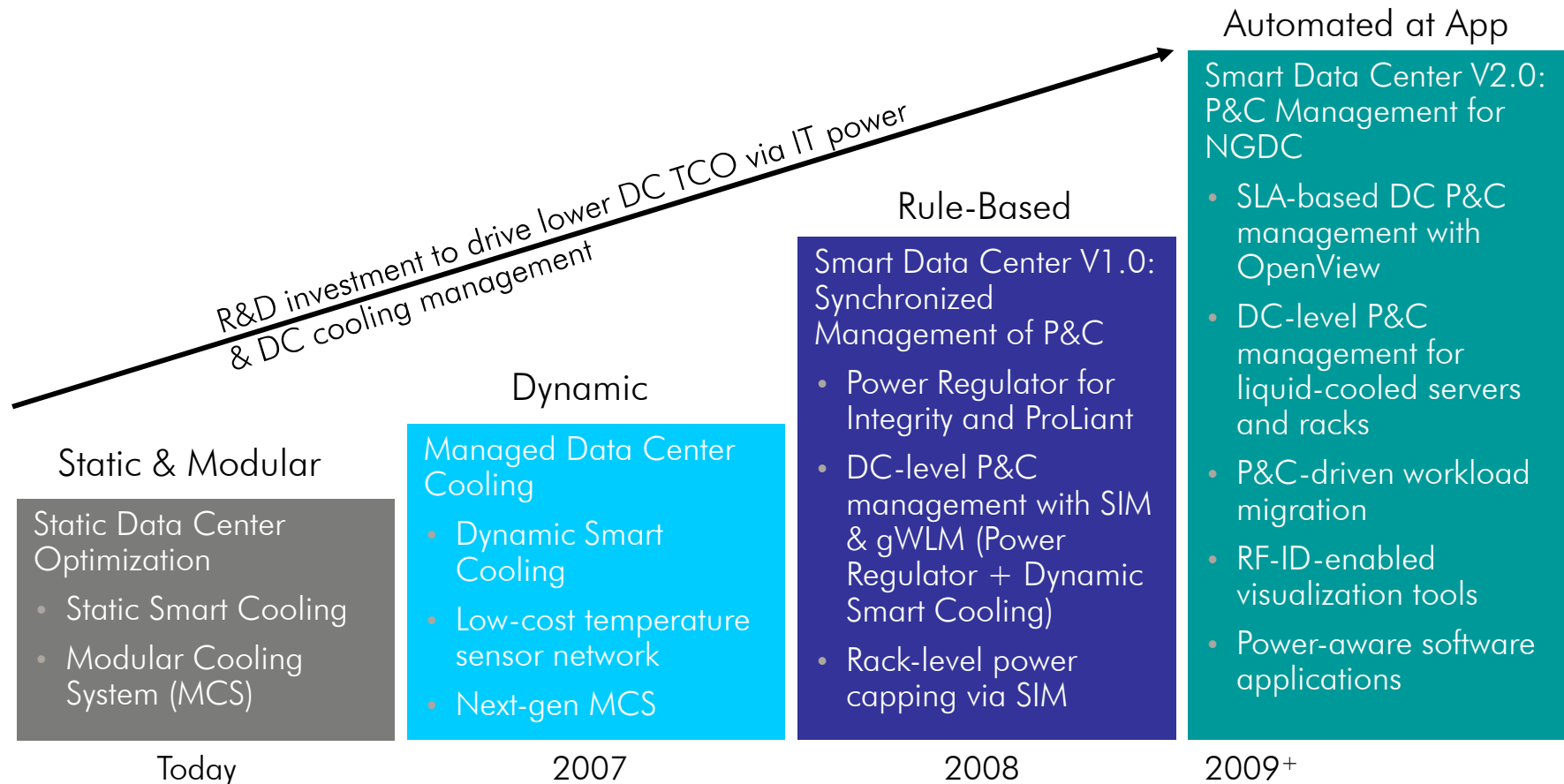
Efficient systems, flexible designs

Leadership in innovation



# Smart Data Center (SDC) Technology Roadmap

Dynamic Smart Cooling (DSC) = data center cooling management  
 SDC = DSC + Power Regulator (IT equipment power management)





# Service Offering - Datacenter Infrastructure Service

## HP Data Center Infrastructure Services

### Thermal Assessment

전산센터 내의 공조 환경 분석 및 개선  
작업 수행

- §Temperature & Airflow Simulation (CFD)
- §Infrastructure standardization
- §Cooling infra Renovation

### Datacenter Assessment

전산센터 전반의 상태 점검 및 개선 작업  
수행

- §Facility , Operation assessment
- §Certification
- §Renovation

### Datacenter Design & Plan Service

전산센터 구축을 위한 사전 개념 설계 작업  
수행

- §Capacity planning
- §Infrastructure Architecture design
- §Time Schedule

### Datacenter Build Service

전산센터의 인프라 구축을 위한

- §Multi-vendor contract
- §Integrated support
- §Project management

### Relocation Service

HP 장비 뿐만이 아닌 전산실 내부의 모든  
시스템에 대하여

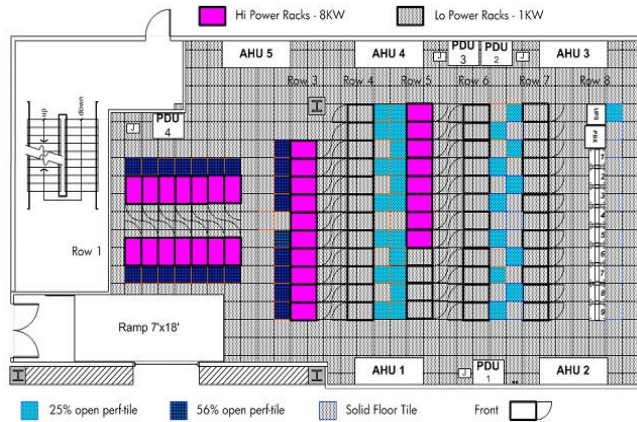
- §Plan (On-line, Off-line)
- §Implementation

### Project Management Service

데이터센터와 관련이 있는 사업에 대하여

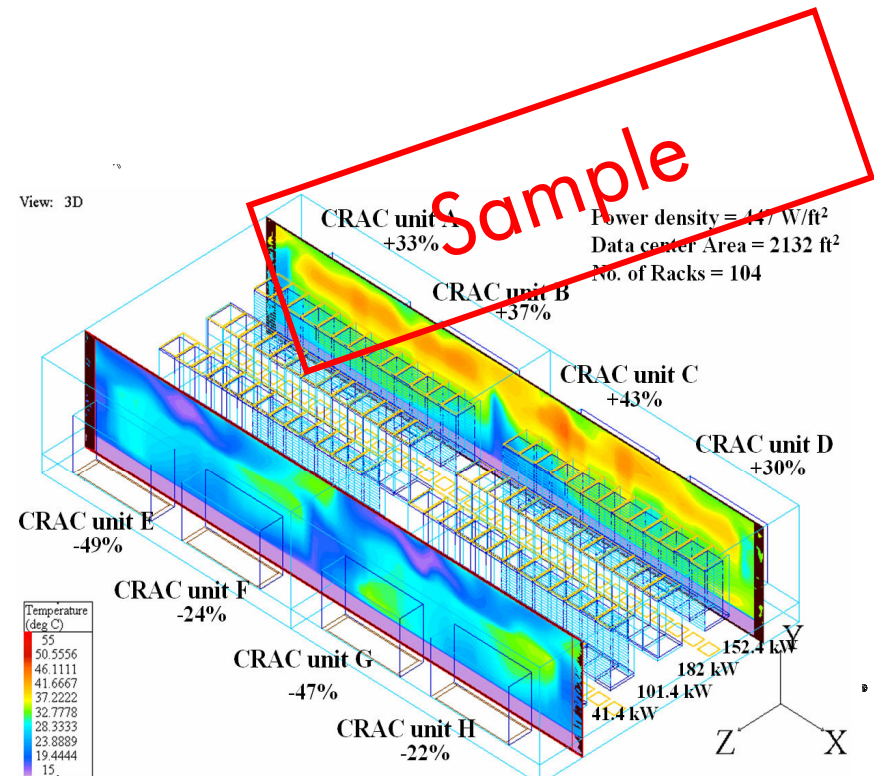
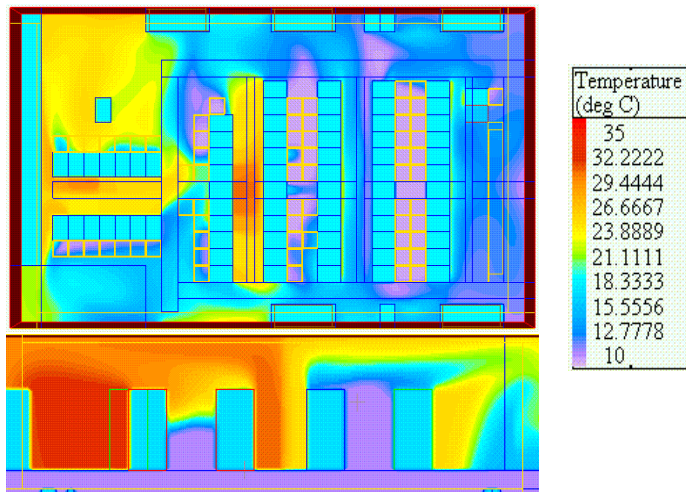
- §Plan
- §Control
- §Management
- §Multi-vendor contract

# Sample - Datacenter Thermal Assessment (3D Cooling)



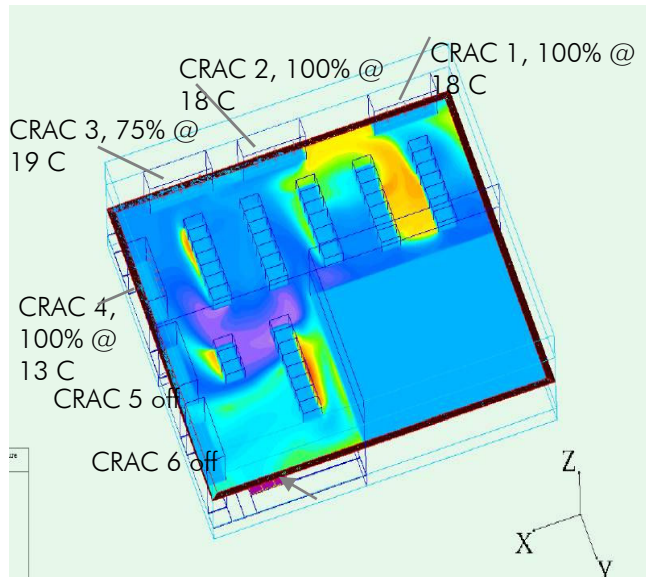
## Cooling / Airflow Assessment Part

- 상태 : Hot Spot Zone 발생
- 향후 예상 되는 장애 요소 : CRAC 증설 및 Blank Panel 추가 Airflow Design 방안 제시



# Case Study: HP Palo Alto, Global Datacenters

## Before assessment



Assumed Best Practices – “we are as efficient as we can be”



## Savings (Extrapolated)

20,000 SF data center

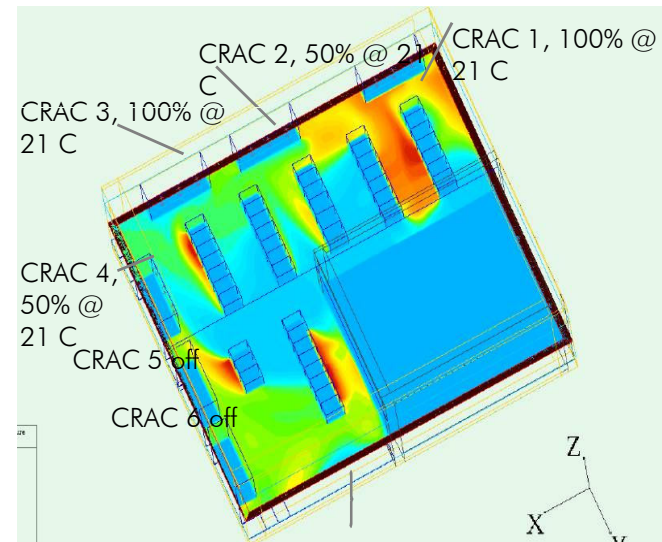
- \$500K per year
- 4.5 million lbs CO2 emissions

equivalent: about 900 round trips NY to S Francisco in an SUV

This is a straight line extrapolation for illustration purposes only to show the scale of what may be achieved



## DC Optimized using Thermal Assessment data



25% reduction in cooling consumption



Q & A



HP Solution World 2007

IT transformation to BT

