

NSC-JST workshop

Development of Cloud Computing Technology in Taiwan

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Outline

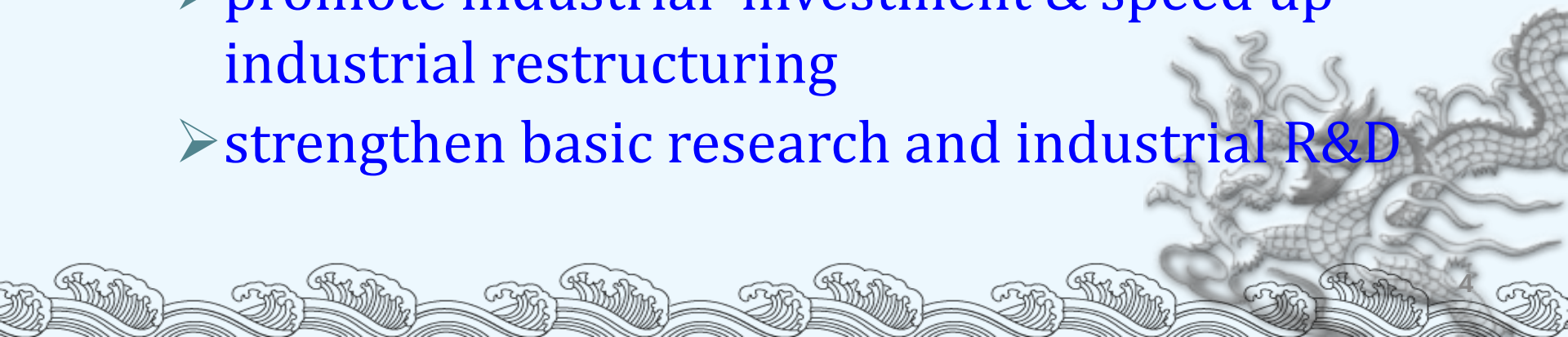
- Government's Policies on developing cloud computing industry and applications
- NSC Program for Cloud Computing Research
- Taiwan's Industry Focuses on Cloud Computing Technology
- Cloud computing related research in my lab



GOVERNMENT'S POLICIES

Taiwan's National Plan (1)

- Vision: To be the leading country of ICT applications and technologies by cloud computing
- Goals
 - improve government's service performance
 - improve people's living quality
 - enhance the added value of Taiwan's ICT industry
 - promote industrial investment & speed up industrial restructuring
 - strengthen basic research and industrial R&D



Taiwan's National Plan (2)

➤ Strategies

- Supply-side: develop highly integrated C⁴ industry ecosystem: **Cloud** system, cloud **Commerce**, broadband **Connectivity**, cloud **Client** device
- Demand-side: G-cloud, output international

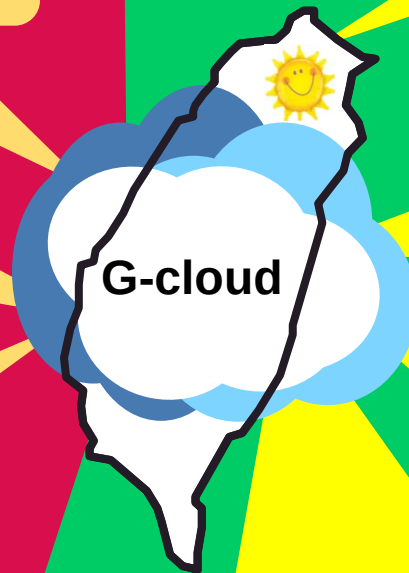


G-Cloud Applications

Electronic invoice services

Tax filing services

Food production
resume services



Cloud services for disaster
prevention & relief

carbon reduction services:
carbon footprint calculation and
certification; reduce 50% auditing
cost

Education cloud: courseware
sharing, ubiquitous learning,
shorten digital divide, life-long
learning

Intelligent transportation services: real-
time navigation, traveler information
service

Cloud Commerce Services

Reading Cloud

electronic
publishing

Chinese
eBook

Medical Cloud

intelligent medical
information system

electronic medical
records

Tour Cloud

unified tour
information portal

tour
recommendation

Surveillance Cloud

personal safety/
home security

warehouse
monitoring

Farm Cloud

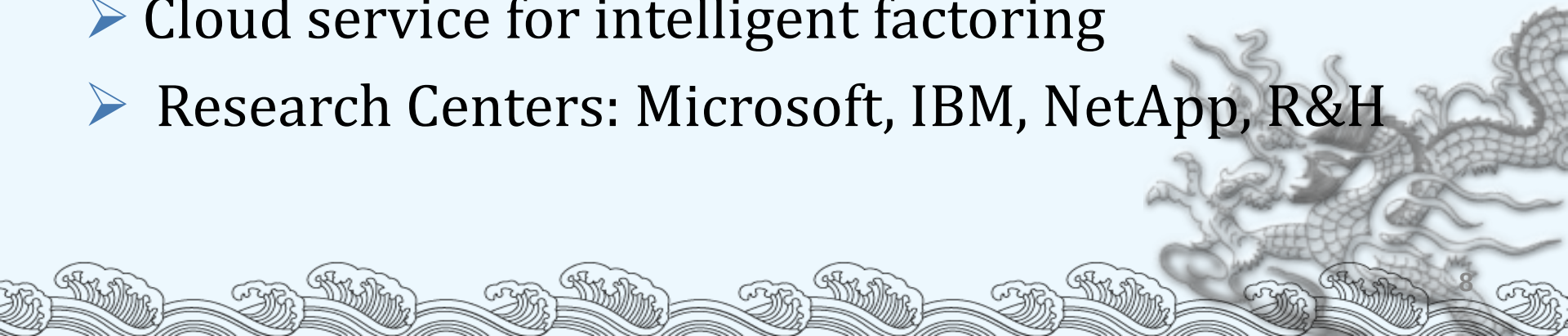
plant factory
organic agriculture

Health Cloud

health care

Other Industry Activities

- Cloud Data Center: Google, major domestic telecom companies
- Connected TV Cloud
- Cloud service for visual effects of movies and animations: R&H
- Cloud service for global manufacturing supply chain management
- Cloud service for intelligent factoring
- Research Centers: Microsoft, IBM, NetApp, R&H

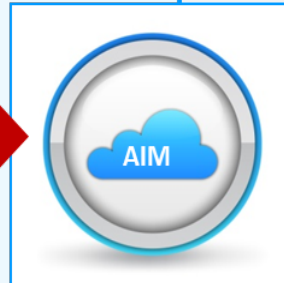


iFactory Cloud Model

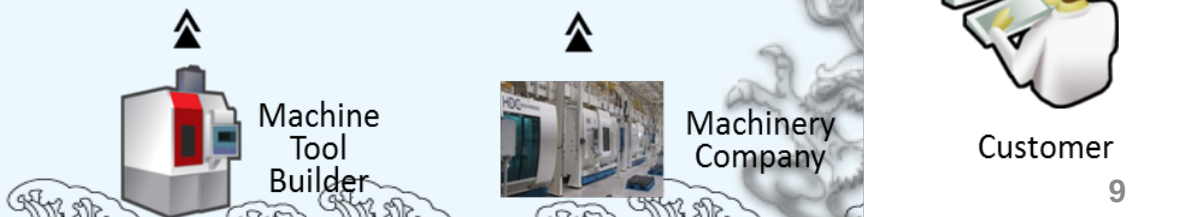
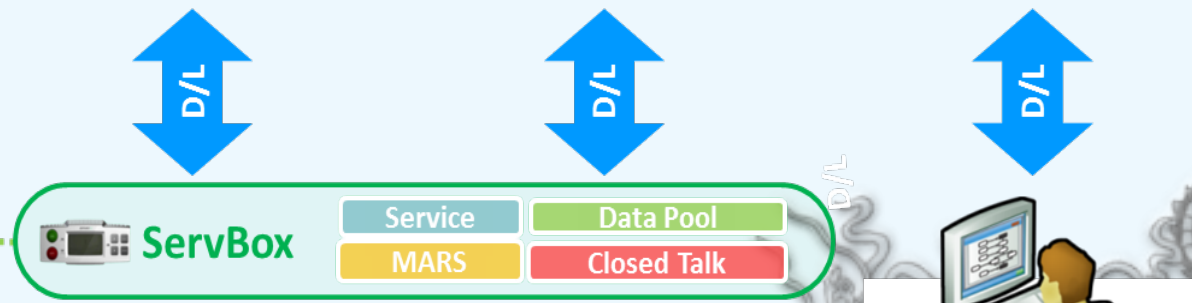
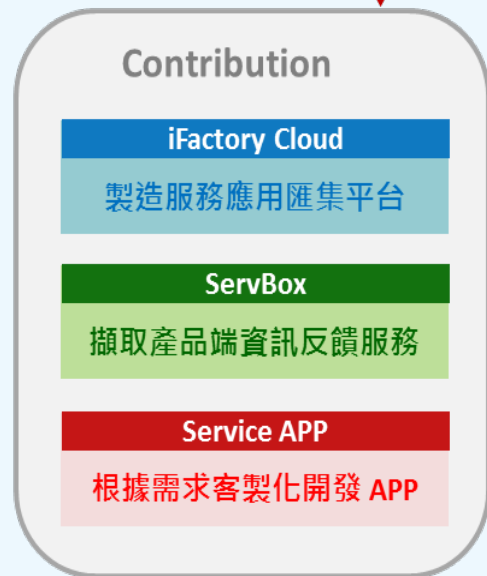
Domain Expertise



Develop



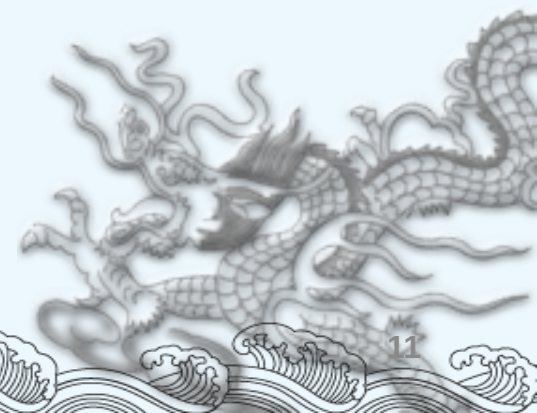
APPS for Intelligent Manufacturing



NSC PROGRAM FOR CLOUD COMPUTING RESEARCH

Research Topics on Cloud System Technology

- Virtualization
- Service flow and workflow orchestration
- Programming model
- World-wide distributed storage system
- Dynamic resource management and provisioning
- Energy-efficient infrastructure and platform
- Availability and reliability
- Data management
- Cloud interoperability



Research Topics on Cloud Service Technology

- Web service and SOA
- Web 2.0 and Mashup
- Privacy and trustworthiness management
- Service quality guarantee
- Universal access for heterogeneous client devices
- Virtual enterprises and organizations
- Cloud migration
- Pilot services: ERP remodeling, smart living services, health care services, ubiquitous cyber TV services, ITS, etc.



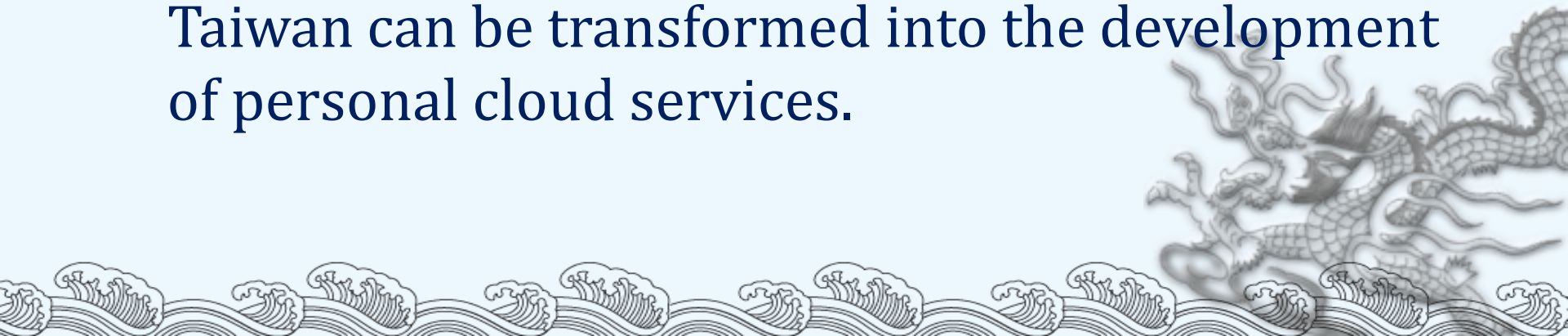
TAIWAN'S INDUSTRY FOCUSES ON CLOUD COMPUTING TECHNOLOGY

SUGGESTED BY THE TECHNICAL EXPERT
COMMITTEE OF CLOUD COMPUTING
ASSOCIATION IN TAIWAN

CLOUD SERVICE- DEVICE-ORIENTED PERSONAL CLOUD

Why Personal Cloud for Taiwan?

- Taiwan companies (ASUS, Acer, HTC, etc.) sale more than 100M devices with their own brands per year → big customer base
- Taiwan's culture and creative Industry is leading in the Chinese world so that Taiwan has high potential for developing creative personal services and Apps.
- The successful experiences of e-Gov services in Taiwan can be transformed into the development of personal cloud services.

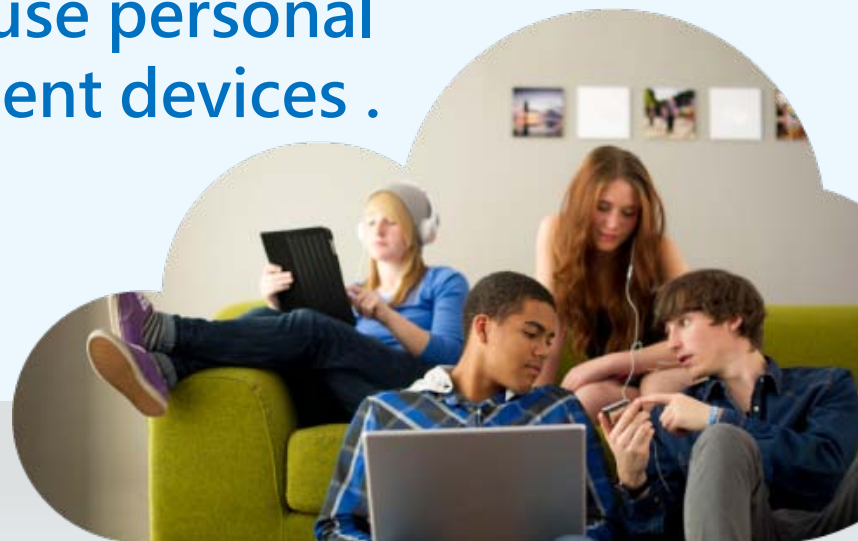
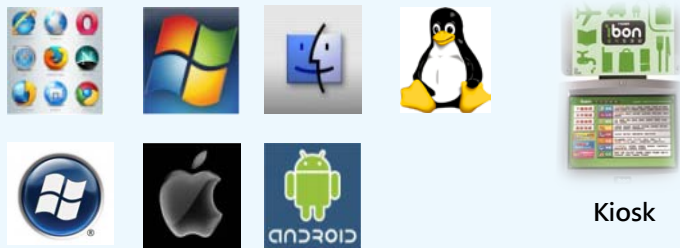


The personal cloud is the consumer expectation to seamlessly store, sync and share content on a contextual basis from platform to platform, screen to screen and location to location that is now the hub of their digital lives.



Personal Cloud Services

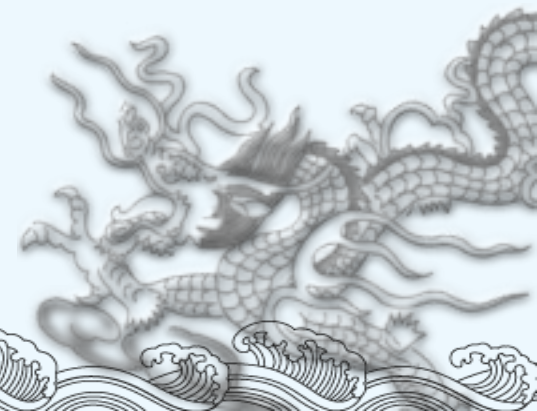
Provide more convenient and high-performance manners to store, retrieve, and use personal contents through a variety of client devices .



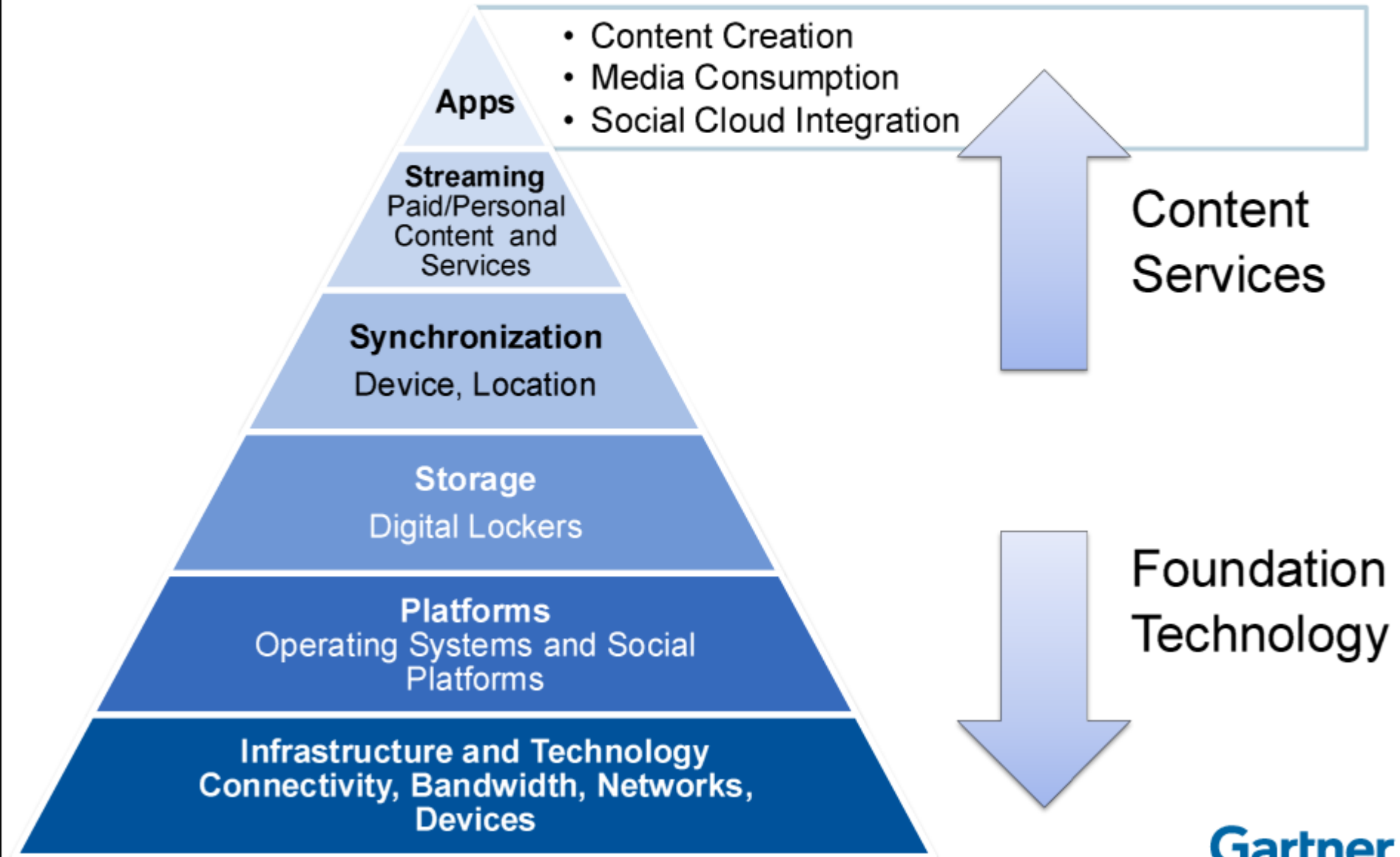
- **Document Portability**
support multi-platforms and file formats, anywhere access, automatic backup.
- **Ubiquitous access of photo album**
sharing and universal access for the cloud photo album.
- **Music streaming**
enjoy music anytime, anywhere, any device.
- **Movie browsing and sharing**

Driving Factors for Personal Cloud

- Consumerization
 - Enterprise IT_Comsumerization
- Virtualization
 - Data, application...
- Software App-ification
 - Everything as an App
- The Self-Service Cloud
 - Ubiquitous computing, unlimited power
- The Mobility Shift
 - Device for every location



Personal Cloud Enablers



SERVER TECHNOLOGY- CLOUD APPLIANCE

From Server OEM To Branded and High Value-added Cloud Appliance Market



iCloud

Trusted

Controlled

Reliable

Secure

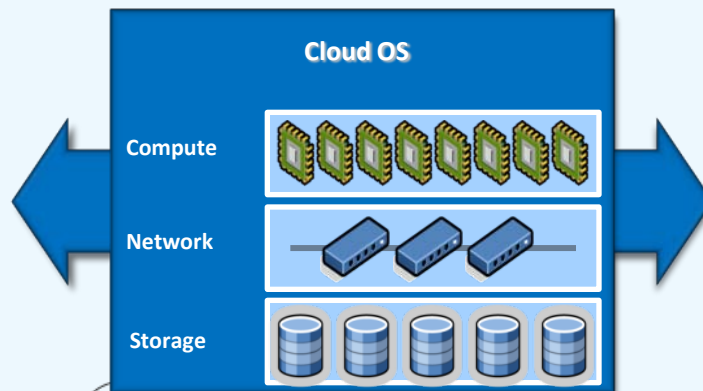
Dynamic

Cost-Efficient

On-Demand

Flexible

Cloud Servers



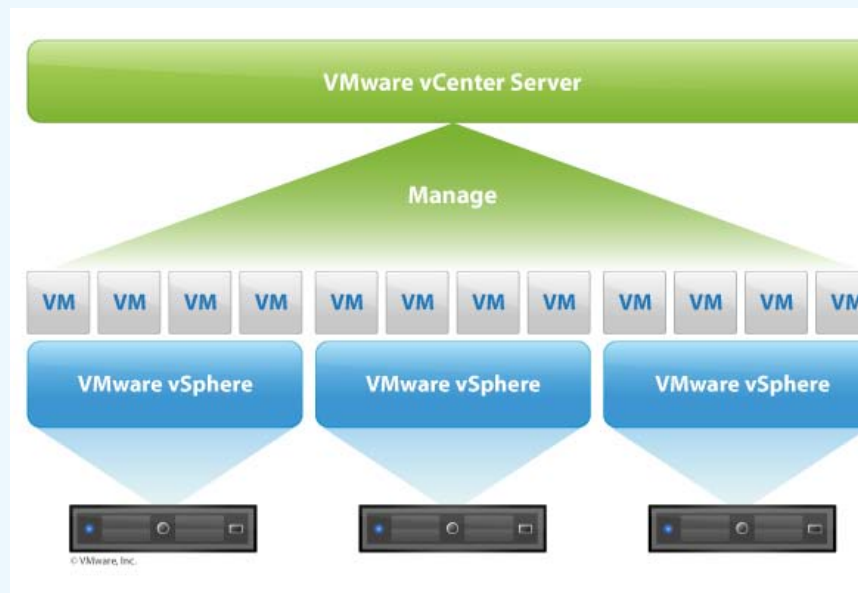
Definition of Cloud Appliance

- Cloud appliance combines compute, network, storage, virtualization and management technologies into prepackaged units of infrastructure. It characterizes and tests horizontal and vertical applications to provide predictable units of performance in virtual environments. (VCE)
- Cloud appliance is designed as a building block of private cloud infrastructure that we can securely and inexpensively deploy large private cloud computing infrastructures from thousands of inexpensive computers with minimal effort. (Nebula)
- Cloud appliance is a good solution for enterprises seeking a fully scalable, pre-packaged, pre-integrated total hardware/software solution to improve IT responsiveness and increase utilization with fewer resources. (AMAX)



Virtual Machine Management

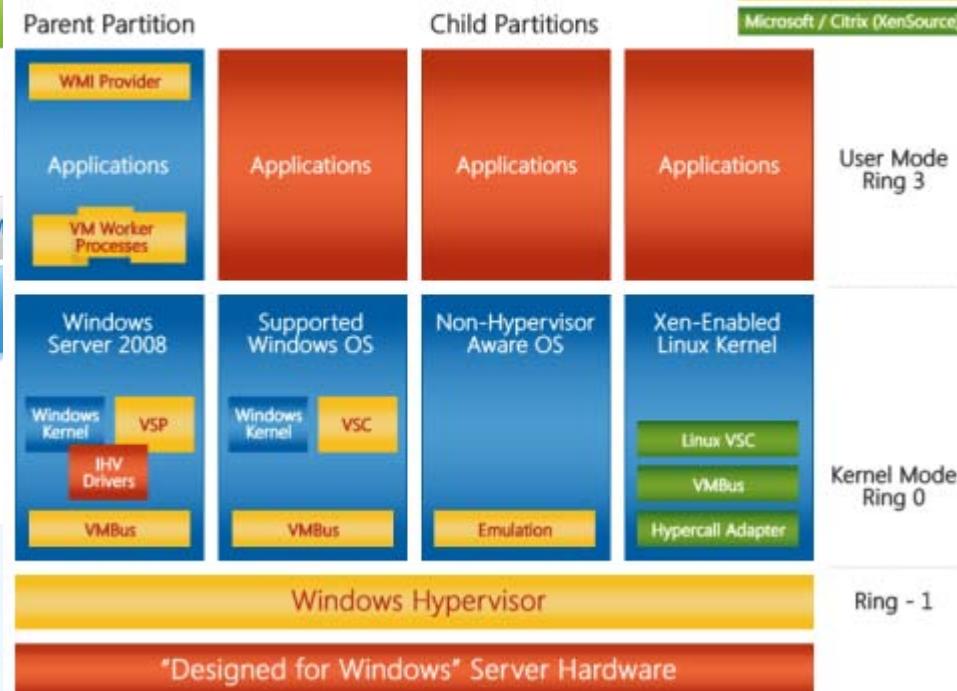
VMware vCenter™ Server



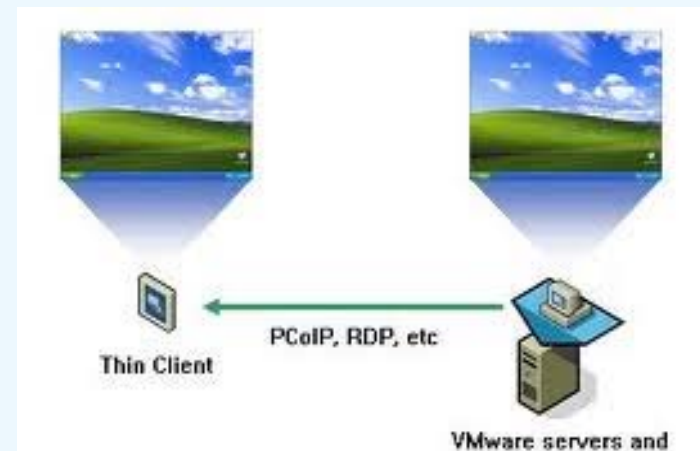
VMware vSphere™



Hyper-V Architecture



Virtual Desktop Infrastructure



'Best of breed' / Comprehensive VDI Stack

Datacenter



Microsoft

Any Windows Device

RDP protocol

CITRIX

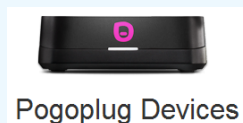
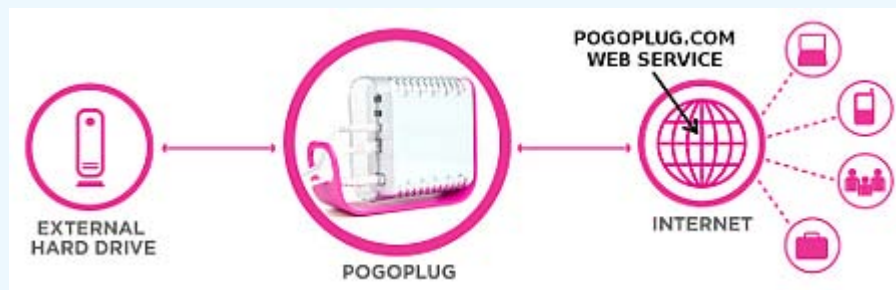
Any Non-Windows Device +
Any Windows Device

HDX (ICA)
Protocol

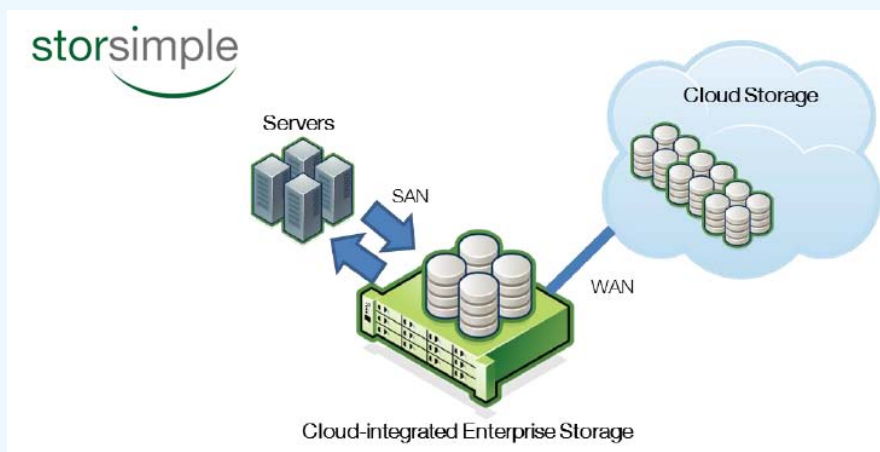
LAN

WAN

Cloud Storage



PROMISE[®]
TECHNOLOGY, INC.



SmartStor Cloud 4U



Technology Development Strategies

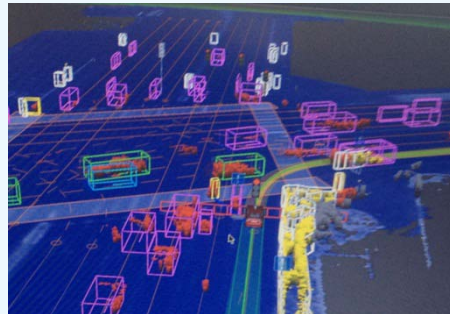
- Green design
- Differentiated designs on computing (e.g., GPU), storage, and network
- System software optimized for hardware platform
- Compatibility with de-facto standards
- Systems management/data center management
- Integrated with 'Killer Applications' from ISVs → application appliances
- User Interface/Experience – ease of use/turn-key solutions
- Leveraging Open source (Open Stack)



CPE TECHNOLOGY- FEATURED AND DIVERSIFIED CLOUD-ORIENTED SMART DEVICES

Trends: Cloud and Device Symbiosis (1)

- Examples: Google Auto-Drive Car
 - Using video cameras, radar sensors and a laser range finder to “see” other traffic, as well as detailed maps to navigate the road ahead – which is all pulled from Google’s data centers.



- Example: Google Glass, Apple Siri



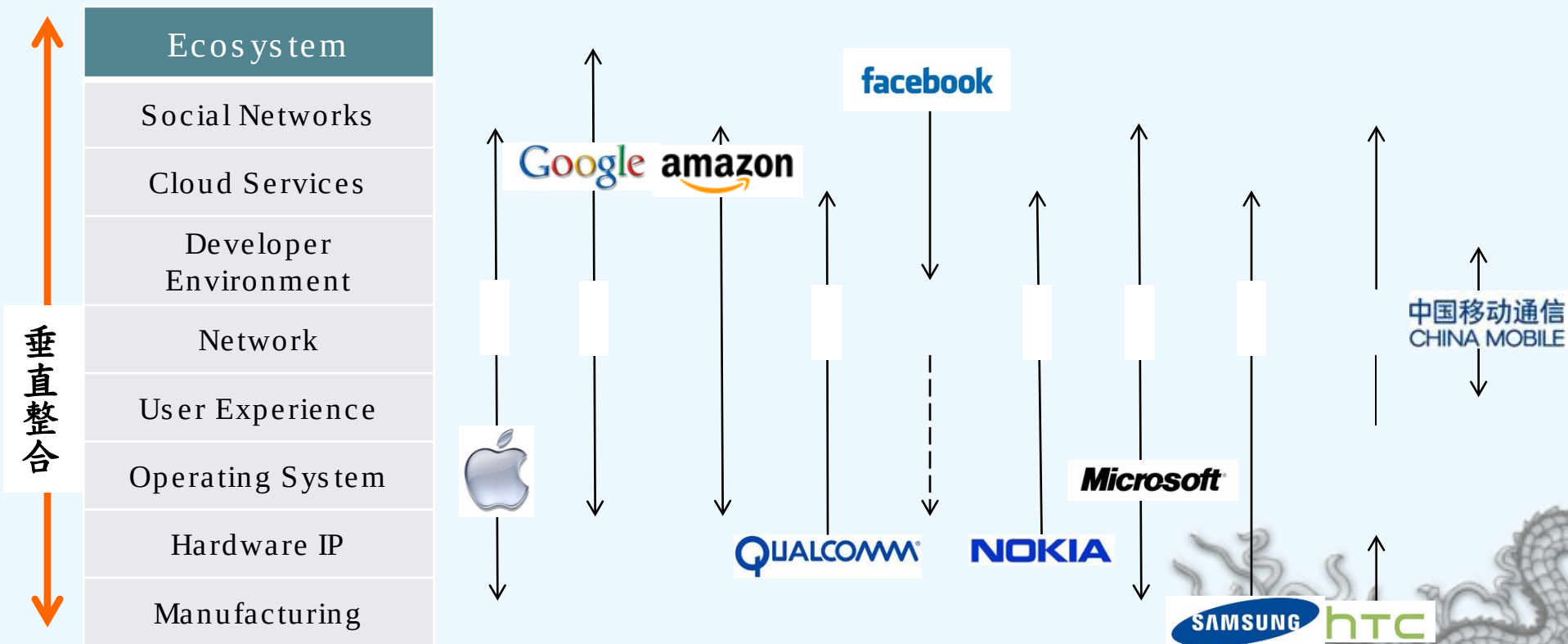
Trends: Cloud and Device Symbiosis (2)

- Cloud Device: Thin and Intelligent
 - Thin: Leave heavy computation/storage load to the Cloud
 - Intelligent:
 - User interface: Natural User Interface, Multimodal User Interface
 - Context/environment sensitive
 - Gathering information through sensors
 - Balancing resources among sensing, computing, and communications.
- Cloud Service: Elastic computing for computation and storage
 - User Interface/User Experience
 - E.g., Natural Language processing, Image recognition
 - Context aware computing: E.g., LBS, personalization
 - Big Data Analytics



Trends– Vertical Integration

➤ The Battle for Production/Operation Ecosystem



Trends: Horizontal Expansion

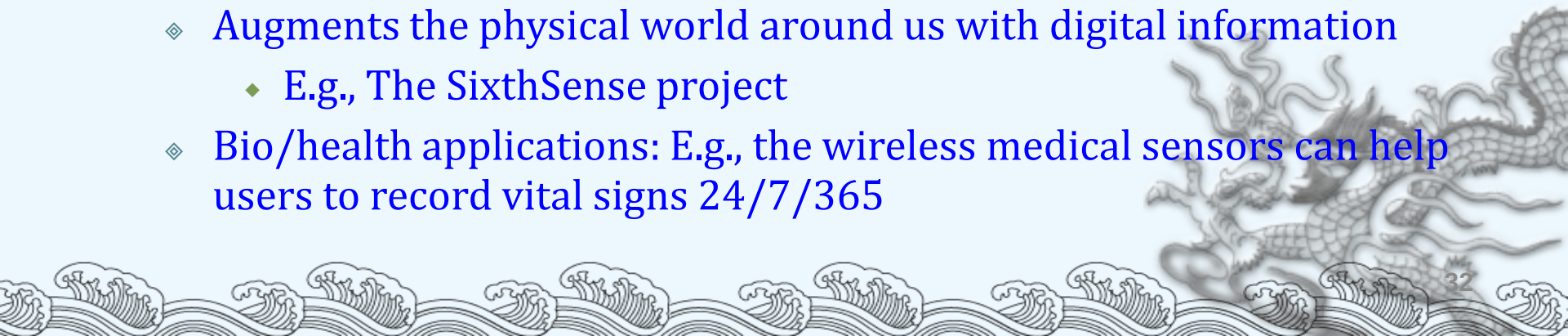
- The Battle for Experience Ecosystems
 - Experience convergence: how the user experience can 'roam' from one screen to the next (phone, PC, TV, mp3 player, etc). That create user lock-in and cross-sales.
 - E.g., Google (Android) and Apple (iOS) expanded from hand-held devices into PAD and then into Smart TV.



Trends: Innovative Cloud Services

A Collected Mind: cloud service is becoming smarter because there are more data gathering by sensors on cloud devices

- ◆ Intention understanding (recognize and act on intention)
 - ◆ Input: Sensors help devices adapt to the service/application scenes and make interactions more easily and naturally
 - ◆ E.g., motion and proximity sensors is used to automatically get into speech recognition mode (Google Voice Search)
 - ◆ E.g., audio sensor (microphone) is used as motion sensor (The SixthSense project)
- ◆ Web meets World: Fusion of data sets across virtual and physical worlds
 - ◆ Augmented Reality : E.g., Wikitude, You R Here
 - ◆ Augments the physical world around us with digital information
 - ◆ E.g., The SixthSense project
 - ◆ Bio/health applications: E.g., the wireless medical sensors can help users to record vital signs 24/7/365



Google Voice Search

- **Motion** and **proximity** sensors
 - detects the movement of the phone to your ear
 - automatically goes into speech recognition mode.
- **Microphone**
- Search databases + speech recognition database
 - the most frequent search terms in its database.
- **Location** sensors
 - A search for "pizza" returns the result you most likely want: the name, location, and contact information for the three nearest pizza restaurants.



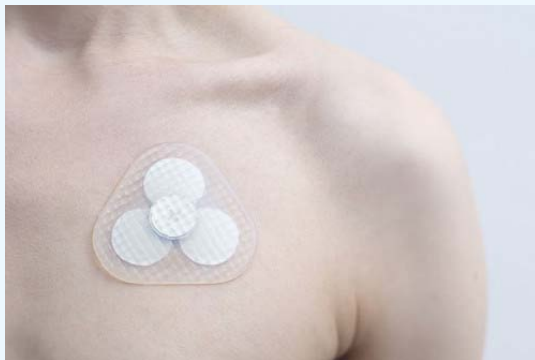
Augmented Reality

- [Wikitude](#): travel guide application for Android
 - Point the phone's **camera** at a point of interest
 - **GPS** to superimpose distances to points of interest
 - **Compass** to keep track of where you're looking
 - The application looks up what it sees in its online database



Mobile Health Assistance Device

- Enable patients to access their health information.
- Synchronize it with medical server where doctors can see the patients' progress and adjust the treatment.



Reference:

<http://futuristicnews.com/mobile-health-assistance-device/>

Mobile Health Assistance Device

- ◆ Withings – Blood Pressure Monitor
 - ◆ Integrated with iOS devices
 - ◆ Keep measurements history
 - ◆ Share the results for greater control



<http://www.withings.com/>

- **Wireless Pacemaker**

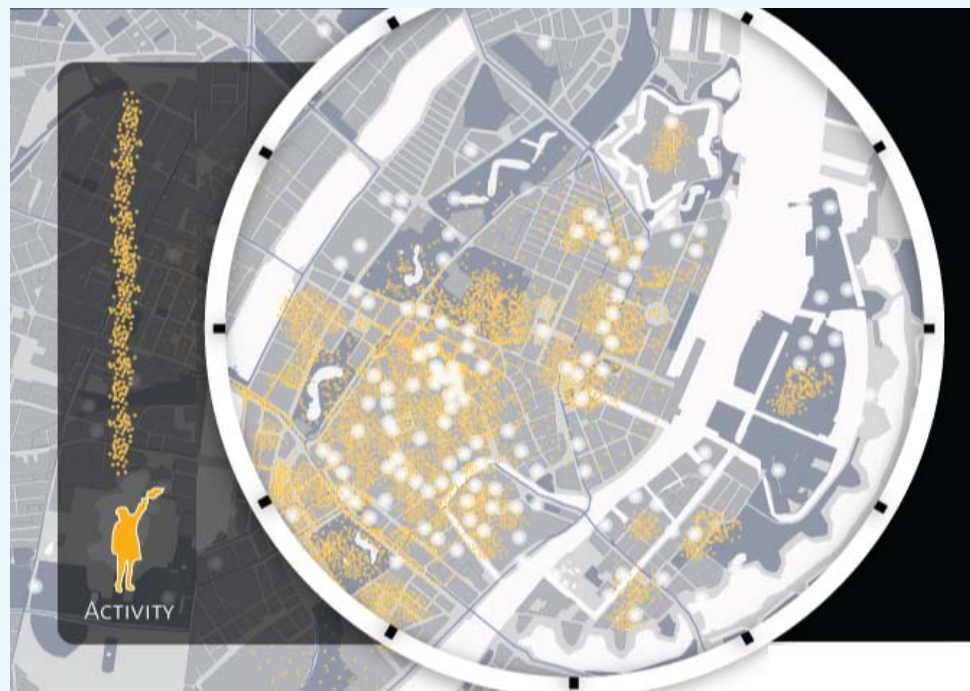
- **A wireless, cloud-connected device designed to simplify the programming of pacemakers.**
- **Facilitate access to electronic medical records during pacemaker procedures**
- **It enables nurses to operate equipment with real-time remote support from doctors and technicians.**



<http://medgadget.com/2011/09/wireless-pacemaker-programming-device-unveiled-at-usc-body-computing-conference.html>

Bio information Application

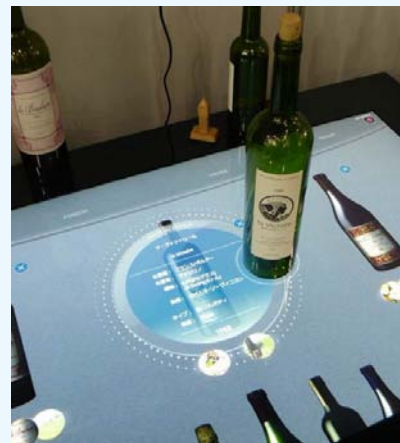
- Biomedical sensors may include sensors of temperature, Galvanic skin response (GSR), pulse, respiration, UWB, etc.
- When people use the smart phones, the biomedical signal are recorded simultaneously.
- The signal could be transmitted to the cloud and processed anywhere.
- The analysis results may indicate the occurrence of flu, accidents, sudden events or activities.
- At last, we can see a living city.



Pictures are modified from
<http://senseable.mit.edu/realtimecopenhagen/>

Table Type Computer Sommeliers

- The embedded into the table computer (SUR40) reads the bar-code on the bottom of the bottle, retrieves the wine data from its database, compares it with the information from a cloud network and presents it to the customer.



Reference: <http://futuristicnews.com/table-type-computer-sommeliers/>

Strategy 1: Smile Strategy

- Promote Taiwan's global brands and service companies
- Emphasize UI/UX (User Interface/User Experience) for smart devices
- Improve core competence on system & software
- Promote open data to encourage the development of innovative cloud applications



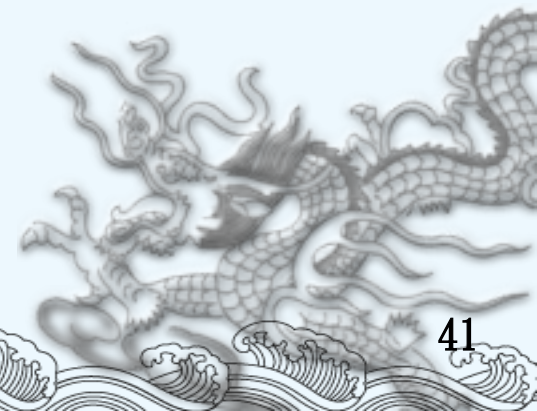
Strategy 2: Blue Sea Strategy

- Develop featured and diversified smart cloud devices and cloud services
- Optimize the vertical integration performance of cloud industry ecosystem
- Transform traditional industries into cloud service market
- Speed up the development of emerging service industries by cloud computing paradigm.



Strategy 3: Deep Cultivation Strategy

- Focuses on development of key components
 - AMOLED panel
 - Memory for mobile devices
 - Highly integrated communication chips
 - Smart sensors
 - Application processors



SYSTEM MANAGEMENT TECHNOLOGY- CLOUD SECURITY

Suggested Cloud Security Topics (1)

➤ Data Governance and Access Management

- Data/database backup
- Data/file protection
- Cloud identity authentication platform
- Cloud storage management

➤ Cloud Security Alliance Projects

- **HIM**, Health Information Management
- **CDG**, Cloud Data Governance
- **TCI**, Trusted Cloud Initiative

Suggested Cloud Security Topics (2)

➤ Cloud Service Security

- Cloud security operation service
- Cloud service incident detection, response and manipulation.
- Mobile App security
- Big data processing security
- Virtualization of IT security equipments

➤ Cloud Security Alliance Projects

- **CloudSIRT**, Cloud computing Security Incident Response Team
- **SecaaS**, Security as a Services
- **Big Data**
- **CTP**, Cloud Trusted Protocol

Suggested Cloud Security Topics (3)

➤ Cloud Audit and Data Management

- E-discovery
- Cloud service audit/certification
- Digital Forensics
- Cloud security consultant

➤ Cloud Security Alliance Projects

- **Cloud Audit**
- **CCM**, Cloud Controls Matrix
- **STAR**, Security Trust & Assurance Resources
- **CAI**, Consensus Assessments Initiative
- **TCI**, Trusted Cloud Initiative

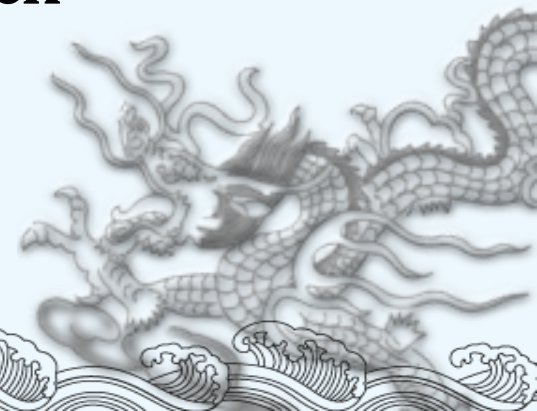
Suggested Cloud Security Topics (4)

➤ Cloud Platform Security

- Security monitoring for cloud service platforms
- VM management platform security
- Trusted middleware

➤ Cloud Security Alliance Projects

- **Top Threats to Cloud Computing**
- **STAR**, Security Trust & Assurance Resources
- **MWG**, Cloud Metrics
- **GRC Stack**



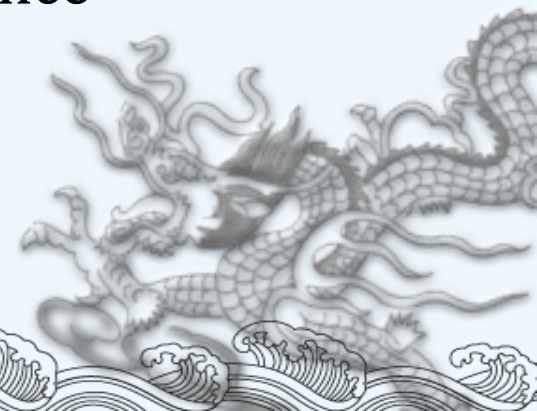
Suggested Cloud Security Topics (5)

➤ Critical Infrastructure Security

- Cloud infrastructure security
- Communication network security
- Mobile communication security
- M2M communication security

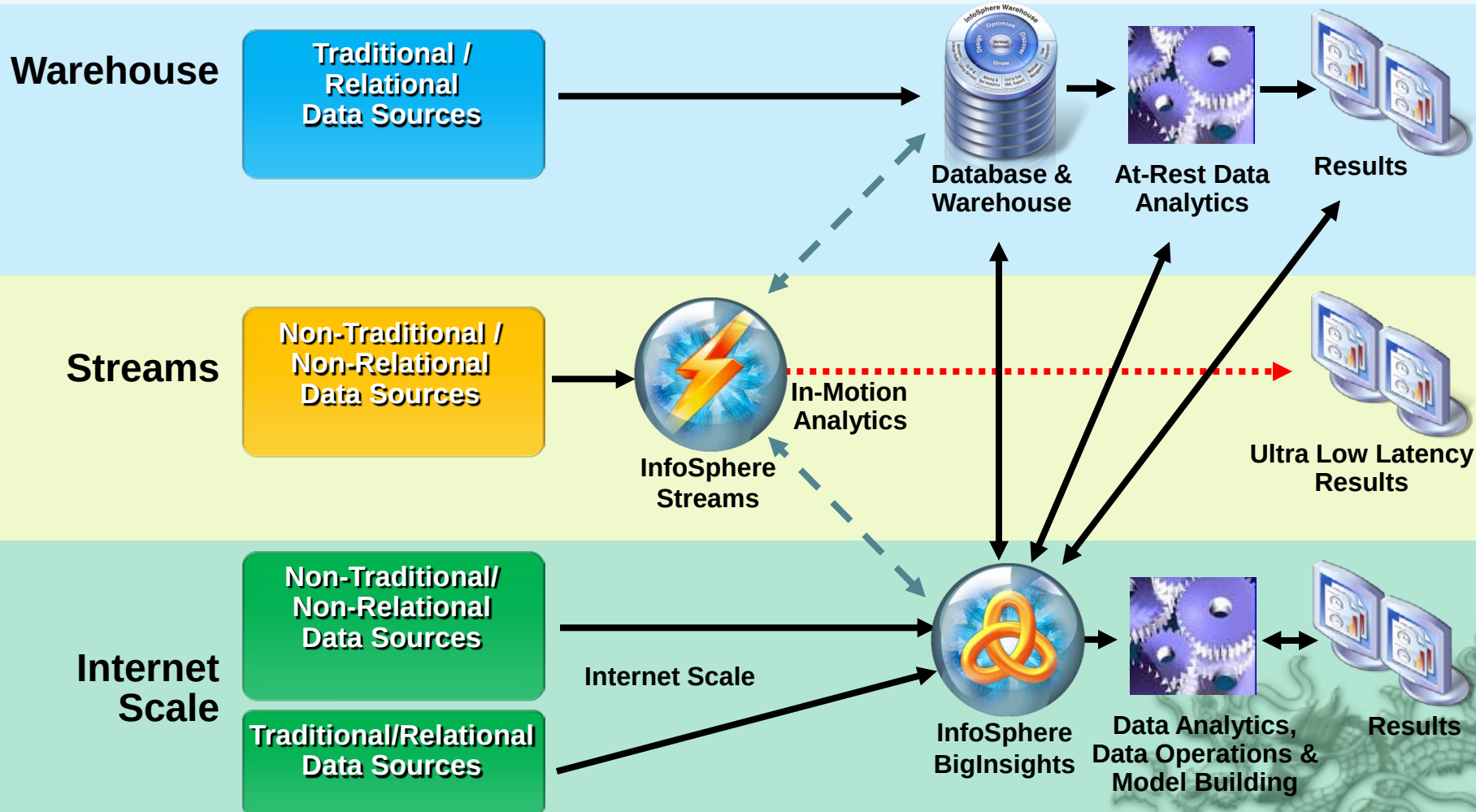
➤ Cloud Security Alliance Projects

- **TWG**, Telecom Working Group
- **CSA Mobile**
- **GRC Stack**
- **CDG**, Cloud Data Governance



DATA PROCESSING TECHNOLOGY- BIG DATA ANALYTICS

Big Data – Extending the Warehouse



Bring together a large volume and variety of data to find new insights



Multi-channel customer sentiment and experience analysis



Detect life-threatening conditions at hospitals in time to intervene



Predict weather patterns to plan optimal wind turbine usage, and optimize capital expenditure on asset placement



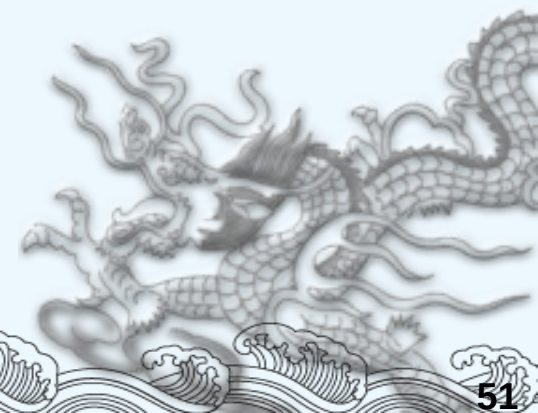
Make risk decisions based on real-time transactional data



Identify criminals, networks, and threats from disparate video, audio, and data feeds

Key Technologies and Skills

- Big data analytics and solutions
 - By means of map-reduce, stream computing
- Knowledge integration from various Cloud applications
- Performance enhancement by specially designed (i.e., application specific) cloud appliances.



CLOUD COMPUTING RELATED RESEARCH TOPICS IN MY LAB

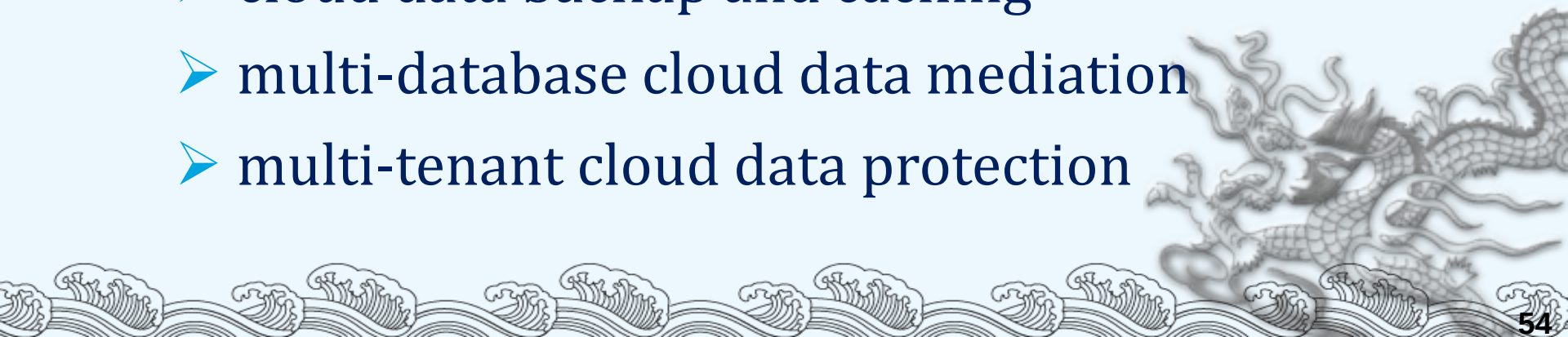
Opportunistic Cloud

- aims to develop technologies for creating dynamic P2P cloud services over opportunistic network
 - protocols for forming and maintaining opportunistic P2P cloud
 - Approaches of trustworthiness evaluation, privacy protection and security guarantee under opportunistic P2P cloud
 - collaborative data sharing and dissemination
 - dynamic resource management schemes
 - virtualization issues on opportunistic P2P cloud



Trustworthy Cloud Service Mediation Platform

- Aims to construct a cloud service platform which is able to guarantee mutual trust among cloud service providers, cloud platform provider, and cloud service clients
 - license-based service management
 - integrated service access and audit management
 - high-performance cloud service gateway
 - cloud data backup and caching
 - multi-database cloud data mediation
 - multi-tenant cloud data protection



IoT-augmented social cloud

- for the purpose of mental care of elderly
 - IoT-augmented social cloud service platform to create smart cyber-physical living space for elderly
 - information analytics approaches for the analysis of behavior patterns and social interaction patterns of elderly on social cloud.



THANKS FOR YOUR
ATTENTION