The Digital Hospital of the Future
Here Now

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Ray Giles WW Digital Hospital Group

21st Oct 2011
Forward-Looking Statements

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Today’s Agenda

1. Introduction & Context
   • Hp in Healthcare and Technology-enabled change

2. Digital Hospitals
   • Norway St Olav & AHUS Digital Hospital status, our experiences and lessons learned

3. Digital Health Solution Framework & Collaborative Approach
   • Digital Hospital Solution Framework (with HCIS)
   • Vision Maps & Discovery Workshops

4. Future Digital Hospital & Integrated Healthcare Vision
The World’s Largest Technology Company

- Fiscal 2010 net revenue of $126 billion, up 10% or $11.5b

- HP acquired 116 companies since ‘86; 30 in last 4 years including EDS, Mercury, IBRIX, LeftHand, 3Com, Palm, 3PAR, ArcSight, Fortify… and recently Autonomy.

**FY10 revenue: $126B**

### REVENUE BY SEGMENT

- **HP Services**, 27%
- **Imaging & Printing Group**, 21%
- **Enterprise Storage & Servers**, 16%
- **Personal Systems Group**, 31%
- **Financial Services & other**, 2%
- **Software & Solutions**, 3%

### REVENUE BY REGION

- **Americas**, 46% Up 10% Y/Y
- **EMEA**, 37% Up 6% Y/Y
- **Asia Pacific**, 17% Up 8% Y/Y

### Healthcare IT Company Revenues

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Rev $B</th>
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<tbody>
<tr>
<td>1</td>
<td>HP</td>
<td>9.7</td>
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<tr>
<td>2</td>
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<tr>
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<td>Dell</td>
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<tr>
<td>5</td>
<td>Cisco</td>
<td>2.7</td>
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### Healthcare IT Services Ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
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<tr>
<td>1</td>
<td>HP</td>
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<tr>
<td>2</td>
<td>IBM</td>
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<tr>
<td>3</td>
<td>Perot Systems</td>
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<tr>
<td>4</td>
<td>ACS</td>
</tr>
<tr>
<td>5</td>
<td>Fujitsu</td>
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Note: (1) HP WW HLS Team (2) IDC HLS sub-segment revenues CY07 (3) IDC HLS sub-segment revenues & Gartner
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HP – Largest Infrastructure Provider to the NHS
Addressing the Cost & Efficiency challenges of the NHS whilst improving Patient Outcomes

**Trust Infrastructure**
HP – Market leader in Server, Storage, Print, Desktop & Laptop [Kable NHS ICT Market August 2010]

**NHS Service Provider**
SWiFT – Since 1995 HP has provided and developed 25 applications, including PAS, Clinicals & Departmentals for Trusts in the SW SHA

**HP Wynyard**
One of the few Tier 3 DC’s in the UK and the only fresh air cooled DC in Europe

**National Infrastructure**
HP dominates NPFIT National Infrastructure

**Supply Direct or via many Partners**
95 HP consultants focused on Health

**DT21**
New ways to contract for better service outcomes

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<table>
<thead>
<tr>
<th>Server Hardware</th>
<th>Storage Hardware</th>
<th>Break-Fix Services</th>
<th>Managed Services</th>
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<tr>
<td>C&amp;W - NHS Mail</td>
<td>HP</td>
<td>HP/HDS</td>
<td>C&amp;W</td>
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<td>Atos - C&amp;B</td>
<td>HP</td>
<td>HP/HDS</td>
<td>ATOS</td>
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<tr>
<td>BT - RIO, Cerner, PACS</td>
<td>HP/IBM</td>
<td>HP/HDS</td>
<td>HP</td>
</tr>
<tr>
<td>CSC - TPP, LRC, PACS</td>
<td>HP</td>
<td>HP/HDS</td>
<td>CSC</td>
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<td>Accenture - Agfa PACS</td>
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<td>HP/HDS</td>
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<tr>
<td>iSOFT IBS - NHS SC &amp; NEP</td>
<td>HP</td>
<td>HP/HDS</td>
<td>iSOFT/IBS</td>
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<tr>
<td>CfH</td>
<td>HP</td>
<td>HP/HDS</td>
<td>CfH</td>
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</table>
In healthcare, the transformation journey has massive dependencies on technology-based solutions.

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Digital Hospitals
TRADITIONAL INFRASTRUCTURE & SYSTEMS
Functional Silos
TECHNOLOGY CONVERGENCE - A CONVERGED INFRASTRUCTURE CAN TRANSFORM WORKFLOW
A platform for innovation and optimised care co-ordination
What is a Digital Hospital
Technology Convergence - Helping To Transform Healthcare Delivery

Pervasive technology integration enabling a real-time information environment and intelligent/automated workflow orchestration

Facilities

Medical

Communications

Real-time Information Integration

Excerpts from IDC Case Study of HP’s Digital Hospital

“... St. Olavs Hospital should be considered the world’s benchmark in terms of tactical and strategic usage of technology in life and death scenarios for the better of their customers, the patients …”
St Olav’s and AHUS – New Digital Hospitals in Norway
Quiet, Efficient, Safe & Quality Care
St Olav’s and AHUS
New hospitals take time

- **St. Olav’s’ Hospital**
  - Trondheim Norway
  - Implementation
    - 2002-2005 Phase 1
    - 2006-2010 (2013) Phase 2
  - HP part of a consortium

- **AHUS**
  - outside of Oslo Norway
  - Implementation
    - 2004-2009 Phase 1
    - 2009-2010 (2011) Phase 2
  - HP co-Prime with Telenor
St Olav’s new hospital
Some key facts

St Olav’s IT Infrastructure 2010
- 5500 IP phones
- 5500 PCs
- 900 patients terminals
- 160 network switches
- 140 servers
- 1000 printers
- 1000 LCD TV’s displays
- 800 interfaced Medical devices
- 400 software applications
- 1500 wireless AP
- 15000 network devices connected

Experienced P1 results at St. Olavs
- Treated more patients in 2007 than 2006 with 400 fewer staff
- Improved patient care with better access to data
- Patients stays are shorter, less inpatients
- Staff productivity increased through better collaboration
- Reduction of annual workload 2006/2007
- Walking distances significantly reduced, due to better floor designs and ICT

“I now have greater freedom to deliver on the core services and more time to spend with my patients, which I used to spend filling out forms, making endless phone calls, chasing relevant patient information and test results, or just tracking down people.”
Aud Olsen, Head Nurse, St Olav’s hospital

30% Outpatient capacity
20% Length of stay
6% Productivity improvement (per year)

“… should be considered the world’s benchmark in terms of tactical and strategic usage of technology in life and death scenarios for the better of their customers, the patients …” - IDC Case Study
AHUS new hospital
2009 Summary Phase 1

**Annual treatments**
- 21,000 operations
- 40,000 in-patients / 190,000 days
- 172,000 outpatients
- 40,000 day treatment patients
- 110,000 imaging diagnostics patients
- 4,300 births

**AHUS IT Infrastructure**
- 3600 IP phones
- 5000 PCs
- 665 patients terminals
- 400 network switches
- 320 servers
- 450 printers
- 450 LCD TV’s displays
- 200 interfaced Medical devices
- 150+ software applications
- 1800 AP wireless
- 9637 networked devices connected
HP’s Key Responsibilities at St Olav and AHUS

- **Consultancy**
  - Program Management
  - Project Management
  - Chief Architect - Solution Design
  - Infrastructure integration
  - Quality assurance, risk and test management

- **Design and implementation**
  - Data network: Core / Access / Wireless
  - Data Center
  - Security
  - Test Management
  - Operations management and ITIL processes
  - Migration from old to new hospital
  - Technical Project Management
  - Training and education of the IT department

- **Operations**
  - Operations, support and maintenance for data centre
  - including all solution components independent of vendor

- **Delivery of HW/SW**
  - HP Service Management Software for solution management
  - Data Network and telephony (Cisco & Nortel)
  - Servers and PC.
  - Security solution software

**Sub contractors responsibilities**
- Telephony
- Messaging Services
- Patient terminals
- Catalogue services
- Identity Management solution
- Audio Visual solutions
- Cabling
Collaboration is Key
Digital Hospitals Need Many Partners Working Together

Prime ICT contractors

- Project management and Infrastructure integration: telenor
- PC, Workstations: HP
- Bedside Terminals: imatis
- Support Services Mgmt System: asando
- Identity mgmt and Directory service: telenor
- IP Telephony: NORTEL, CISCO
- Data Centre: HP

Education
- Digital dictation: max manus
- Self Check-In & Queuing System: imatis
- Electronic Whiteboards: imatis
- Sign-on/authentication: telenor
- Network: HP, CISCO
- Digital TV distribution, TV Set Up boxes: imatis

Operation
- Print: HP, Canon
- Real Time Location System: imatis, CISCO
- Messaging System: imatis
- Audio/Video: YIT
- Nurse Call: imatis, BEST
- Cabling: bravida
Health Center of Excellence (HCOE)
Center moved to AHUS and re-opened Sept 1st

- A Global DHI Center with a “2 bed hospital”, “nurse station” and conference room, located in Oslo, Norway
- Gathering and obtaining optimal use of key health competences and resources from HP and partners
- Coordinates global visits, activities, programs with combined reference visits at Ahus, the new University hospital outside Oslo
- Experiences from St.Olavs Hospital and AHUS Hospital projects present in the Center
- Tailor-made presentations for the visitors based upon their requirements and experiences from previous visitors
- Test center for new solutions and DH integration
- Approximately 300 visitors a year
- Moved the Center to AHUS University Hospital in 2011 Sept 1st

Please visit www.hp.no/hcoe
Digital Health Solution Framework
HP Digital Health Framework

Enabling Change

HP’s “Digital Health” portfolio delivers increased operational efficiencies, orchestrates care inside the four walls of a hospital (Digital Hospital) and extends care coordination with the physician office, to the home and to mobile consumers (V-Health).

HP Digital Health Framework
Collaborative Approach
Vision Maps, Strategic Partnering Discovery Sessions & Roadmap Development

Collaborative Visioning and Discovery
Vision Maps, best practice and futures collateral

The patient journey through the digital hospital with enhanced experience and improved care delivery

The integrated healthcare community of the future – focusing on patient wellness and preventative medicine.

The maps are supported by detailed workflow, data flows and technology-enablement best practice, solutions and labs futures.

Collaborative Approach
Vision Maps, Strategic Partnering Discovery Sessions & Roadmap Development
HP Digital Hospital Solution Framework
Lessons Learned - Functional Elements for a Digital Hospital
Digital Hospital Solution Framework
Example of ICT Partner delivery services

Core ICT Partner areas
1. Networks
2. Servers & Storage
3. Client Computing Infrastructure (VDI)
4. Unified Communications & Collaboration (UC&C)
5. Messaging & Alerts / Integration Bus inc. RTLS services
6. Patient Identification
7. Patient & Clinical Interactive Systems
8. Asset Tracking & Management
9. Kiosks & Way finding
10. E-Content Management (including Print Mgmt.)
11. Document Capture & Route
12. Business Technology Optimization (part of Unified Operations and Platform)
Digital Hospital Solution Framework - Applications
Extension through HCIS software

An integrated system across multiple hospitals, day care centers and ambulatory centers, with a single EPR for continuum of care across the organisation

Integrated Clinical & Administrative Information Systems

Flexible technology: J2EE (Web based, 3-tiers)

Powerful integration features and HL7

Modules:
- Electronic Patient Record
- CPOE and Results reporting
- Referrals
- Ambulatory scheduling and appointments
- ADT and Emergency system
- E-prescription
- Day hospital
- Nursing module
- Operating Room Management
- Waiting list Management
- Billing
- Patient Accounting & insurance claims
- Integrated Primary Care
- Workflow
- DW/OLAP system
- Clinical Pathways (Roadmap)

Implementations since 2001:
- Over 90 in Spain
- 4 in Portugal
- 1 in India with 2 others underway

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Integration Engine Example
Integration Engine enabling effective Care Co-ordination
A day in the life of a Nurse: Nurse Call

- Patient pushes the Nurse call button.
- Nurse receive nurse call alert on mobile device.
- Ward staff receives assistance call and go to patient room.
- Nurse acknowledge call and establish two-way voice communication with patient.
- Patient receives call back from nurse. Tell nurse she is in pain.
- Nurse goes into room and push the nurse call room presence button.
- Ward staff gets into room and push presence button.
- Situation is under control and staff reset nurse call alarm.

Integration Engine

- Dashboard/Nurse Station
- Nurse Call
- TAP, ESPA 4.4.4
- WS
- HTTP, AXL
- LDAP
- Active Directory
- Audit Repository

Unified Communication

- Audio/SIP
- Video/VideoCo.
- VoIP
- IM
- Email

Clinical Staff

Patient receive nurse call alert on mobile device.
Royal Adelaide
30 Year PPP – Starts 2011 and opens in 2016

800 Beds (700 multi-day beds, and 100 same day)

Government design goal are for 6,000 staff, treatment of over 400,000 outpatients and overnight care to approximately 85,000 inpatient admissions per year. Average length of stay for multi day patients of 5.6 days. Will assess ~86,000 emergency patients per annum; and ~400,000 out patients per annum.

Integrated with the health facilities of the universities in Adelaide for full range of undergraduate and post graduate education

Focus on patient centred care will be embedded in the overall design and planning, including the use of gardens, water features, natural light, colour, artworks and views in its design while also providing for quiet and privacy.

State-wide services include: Major burns, Trauma, Spinal, Renal transplantation, Neurosurgery, Complex vascular and Hyperbaric medicine.
Future Digital Hospital & Integrated Healthcare Vision
Day-in-the-life of a Digital Hospital  -> Video
Technology Helping Transforming Healthcare

1. Digital information—minimise and eventually eliminate paper, film etc.

2. Digital communications—leverage technology to facilitate better communications between patients, staff, clinicians and third party organisations

3. Automated systems—replace manual systems with leaner, automated processes and contribute to improved clinical care and safety

4. Interoperable systems—single view of the patient across disparate systems, enabling new processes and optimised workflows

5. Data at the point of care—additional integration between IT, medical, communication and building technologies to create a real-time hospital information environment
Digital hospital – business value framework

**ULTIMATE BUSINESS GOAL**
- **Speed Innovation to Practice**
- **Improve Operational Efficiencies**
- **Improve Quality of Care**

**EXECUTIVE KPIs**
- **COST CONTAINMENT**
  - Cut Operating Expense
- **COMPLIANCE**
  - 100% compliance (HIPAA, JACHO, HITECH etc.)
- **QUALITY OF CARE**
  - Minimizing Medical Errors
- **PATIENT THROUGHPUT**
  - Increase: 10% per year

**CORE KPIs**
- **COST**
  - 5% Decrease
- **VIOLATION RATE**
  - 10% Decrease
- **ERROR RATE**
  - Errors: 0% in 5 years
- **ROA (Asset Utilization)**
  - Increase
- **LENGTH OF STAY**
  - Decrease

**BUSINESS INITIATIVES**
- **Cut Enterprise Costs**
- **Adopt IT for Process and Productivity Improvement**
- **Create Innovative, Error-proof, more Productive Digital Clinical Processes**

**OPERATING KPIs**
- **PROCESS/FUNCTION**
  - Costs per bill and per claim
  - Cost per patient day
  - Cost of medical negligence
  - Cost of supplies
  - Adhere to all compliance requirements
  - Reduce cost of IT
  - Integrate Information
  - Secure Information
  - Meaningful Use
  - IT solution implementation in time, in budget
  - Bed occupancy rate
  - Patient satisfaction rate
  - Task turnaround time
  - Use of analytics in all decision making
  - Time spent on direct patient care
  - Emergency response time
  - Medication Error rate
  - Mean time to diagnose
  - Staff turnover ratio
  - Patient Wait times
  - In-patient discharge cycle time

**DIGITAL HOSPITAL POINT SOLUTIONS**
- Real time location services
- Patient ID Wristbands
- Converged Infrastructure
- Servers & Storage
- Unified Communication & Collaboration
- Client Virtualization
- Alerts & Messaging Integration
- HP Exstream
- Clinical & business intelligence
- Clinical Point of Care & Integrated Bedside Terminal
- Kiosks & Wayfinding
- Client Virtualization
- Alerts & Messaging Integration

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What's next?
Integrated Digital Healthcare Community – “Strategic Themes”

Speed Innovation to Practice
- Personalized Medicine
- Evidence based Medicine
- Future Ready

Improve Quality of Care
- Patient-centric Care
- Real-time Care
- Remote Medicine

Collaborative Treatment

Performance Metrics
- Velocity of Care

Integrated Digital Healthcare Community – "Strategic Themes"

- Future of Healthcare
- Collaborative Treatment
- fringe
- integrated digital healthcare community
- patient-centric care
- real-time care
- remote medicine

Improve Operational Efficiencies
- Integrated Care Environment
- Frictionless Workflow
- Invisible “Intuitive” Technology

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Summary – It’s a Transformation Journey
Follow-up options to start learning more

- Visit Digital Hospitals/HCOE in Norway
- Digital Hospital deep-dive follow-up meetings and webinars
- Visioning & Discovery Day Workshops
- Technology deep-dive follow-up meetings, webinars and DC visits
- IT Strategy and EA Strategic Consultancy

Contact Mark Howarth for more details
mark.howarth@hp.com
+44 (0)7500 918874
Extending care coordination into the community

What is V-Health?

“The use of medical information exchanged from one site to another via electronic communications to improve patients’ health status”

American Telemedicine Association

Mobile consumer

Home care

Physician office

Hospital

Digital hospital

Care management & Virtual health

Personal medicine & Wellness

Extending care outside the four walls of a hospital

Acute ➔ Ambulatory ➔ Chronic disease management ➔ Wellness

Information – Integration – Orchestration

Telemedicine

Clinical Collaboration

Care Management

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“V-health”: virtual health management

Enable care coordination across the health eco-system

Telemedicine: 
Doctor/patient examination

- Lack of specialists outside of large cities
- Travel expenses for patients
- Accessibility to care outside of hospital

Clinical Collaboration: 
Consultation between physician and specialists

- Consulting each other efficiently
- Improving quality of collaboration
- Sharing medical data

Home Care: 
Remote Patient Monitoring 
Chronic Disease Management

- Overcrowded hospitals
- Desire of patients to remain at home
- Chronic disease management

Virtual Collaboration 
Enable care coordination across the health ecosystem
HP’s Care Management Workflow Solution

**Case Management**
- Surveys & Health Risk Assessments
- Collaborative Care
- Auto Generated Care Plans/POCs
- Standard Clinical Criteria/Protocols
- Scheduling & Alerts
- Correspondence & education material
- Referrals

**Disease Management**
- Predictive Modeling
- Surveys & Health Risk Assessments
- Continuity Care
- Auto Generated Care Plans/POCs
- Clinical Data including Rx
- Care Scheduling & Alerts
- Correspondence & education material
- Referrals

**Lifestyle Management**
- Health Risk Assessments
- Risk Assessments
- Interventions Triggers
- Goal Setting and Monitoring
- Educational Programs
- Automation for Health Coaches

**Prior Authorization**
- Medical, Dental, Services, DME
- Standard & Custom Criteria
- Rules Engine, Auto Authorizations
- Hearings and Appeals
- Referral Management
- EDI, FAX and Manual Submissions
- Cost Tracking

**Utilization Management**
- Concurrent, Prospective & Retrospective Review
- Standard & Custom Guidelines
- Pre-certification
- Discharge Planning
- Hearings and Appeals
- Automated Workflows

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Care Network Solution Bridges the Healthcare Continuum

Data Aggregation

Clinical Analytics

Care Network Solution

Population Wellness

Personalized Services

E-mail

Web

PDA

Health Monitoring

Digital Hospital

Personal svc

Consumer @ Home

Tele-monitoring

Disease Mgmt

Care Mgmt

Surveillance

Allantes

Business Intelligence

Analytics

Predictive Modeling

Atlantes

EHR, Portal

HCIS eRx

Harmony

Policy, Security

Virtualized Care

Tele-monitoring

Health Monitoring

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Virtualized Care
A day in the life of a patient: Patient Journey

Porter requested to pick up patient. AGV requested to pick up dirty surgical equipment.

Patient arrives at hospital. Checks in using kiosk.

Porter confirms

OR staff

Patient

Porter

Dashboard
Nurse Station

Integration
Engine

Video/Audio

Unified
Communication

Video/Audio

Patient

WS

WS

WS

WS

WS

LDAP

DashBoard
Nurse Station

Integration
Engine

Equipment is scanned and AGV requested.

Hospital/Clinical Information System

Equipment arrives in CSR, scanned and checked back into CSR inventory

Porter confirms

Equipment is scanned and AGV requested.

Porter

CSR Staff

HIS/PAS

PACS/RIS

EPR/EMR

Finance

LIS

Surgeon

Surgeon puts patient on surgical schedule

Patient arrives at hospital. Checks in using kiosk.

Patient

E-mail

IM

Video Conf

VoIP

Bedside Terminals

Kiosk Station

PA System

Active Directory

Audit Repository

Mechanical

Lighting

Hydraulic

Chute System

Ceil

Escalator

Electrical

Vertical Transport-
AGV

Pneumatic Tube

BACNet, OPC, WS

HL7/WS

BACNet, OPC, WS

Integration Engine

Surgeon puts equipment for surgery

CSR staff request equipment for surgery

Porter requested to pick up patient. AGV requested to pick up dirty surgical equipment.

A day in the life of a patient: Patient Journey
INFORMATION AVAILABILITY
Run a Hospital Like a Normal Business & Concierge Services

Any image to any screen

Nurses’ Station

Patient Terminal
VoIP, Video, Radio,
Internet, Building Control Gateway,
Patient Chart, EPR, PACS
(level 6 EMRAM)

VoiP, Video, Radio,
Internet, Building Control Gateway,
Patient Chart, EPR, PACS
(level 6 EMRAM)

Any image to any screen

VoiP, Video, Radio,
Internet, Building Control Gateway,
Patient Chart, EPR, PACS
(level 6 EMRAM)

Wireless Medical devices

Voice recognition for
doctors’ notes

Patient Chart

Digital forms

All equipment is “connected”

Nurse Call
Digital hospital – business value framework

Best-in-class Decision Support (BI/BA)

Business KPIs

Quality of Care

Redesigned Processes for High Quality Care Delivery

Efficiency

Integrated IT, medical, communication, and facilities technologies for efficiency

Productivity

Real-time, Pervasive IT environment for better operation

Healthcare Provider

Diagnostics
Pharmacy Services
Treatment
Nursing
“Hotel” Services
Diet
Rehabilitation
Patient

Digital hospital – business value framework

Best-in-class Decision Support (BI/BA)

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Digital hospital – business value framework

Best-in-class Decision Support (BI/BA)

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Productivity

Real-time, Pervasive IT environment for better operation

Healthcare Provider

Diagnostics
Pharmacy Services
Treatment
Nursing
“Hotel” Services
Diet
Rehabilitation
Patient
Creating the Digital Hospital

1. Improves patient satisfaction and clinical outcomes by providing access to educational material, entertainment, and self-service applications on interactive patient terminal.

2. Reduces storage costs and facilitates image sharing with HP's Medical Archive solution and SWD platforms.

3. Enhances collaboration and communication through the integration of multiple networks and medical devices into a unified IP-based communications network (partnered with Imatis).

4. Improves the efficiency of clinical staff through the use of workflow integration, use of location-based services, and mobile communications.

5. Improves the physician's ability to navigate complex genetic information. Data from genetic sequencers is captured, aggregated with our medical data, and a clinical intelligence system assists the medical professional in selecting the best diagnosis or therapy.

Accelerate business growth
Speed innovation to transform health

Lower costs/increase efficiency
Improve operational efficiencies

Mitigate risks
Improve quality of care

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