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Architecting Disruptive Digital Product-Service Systems

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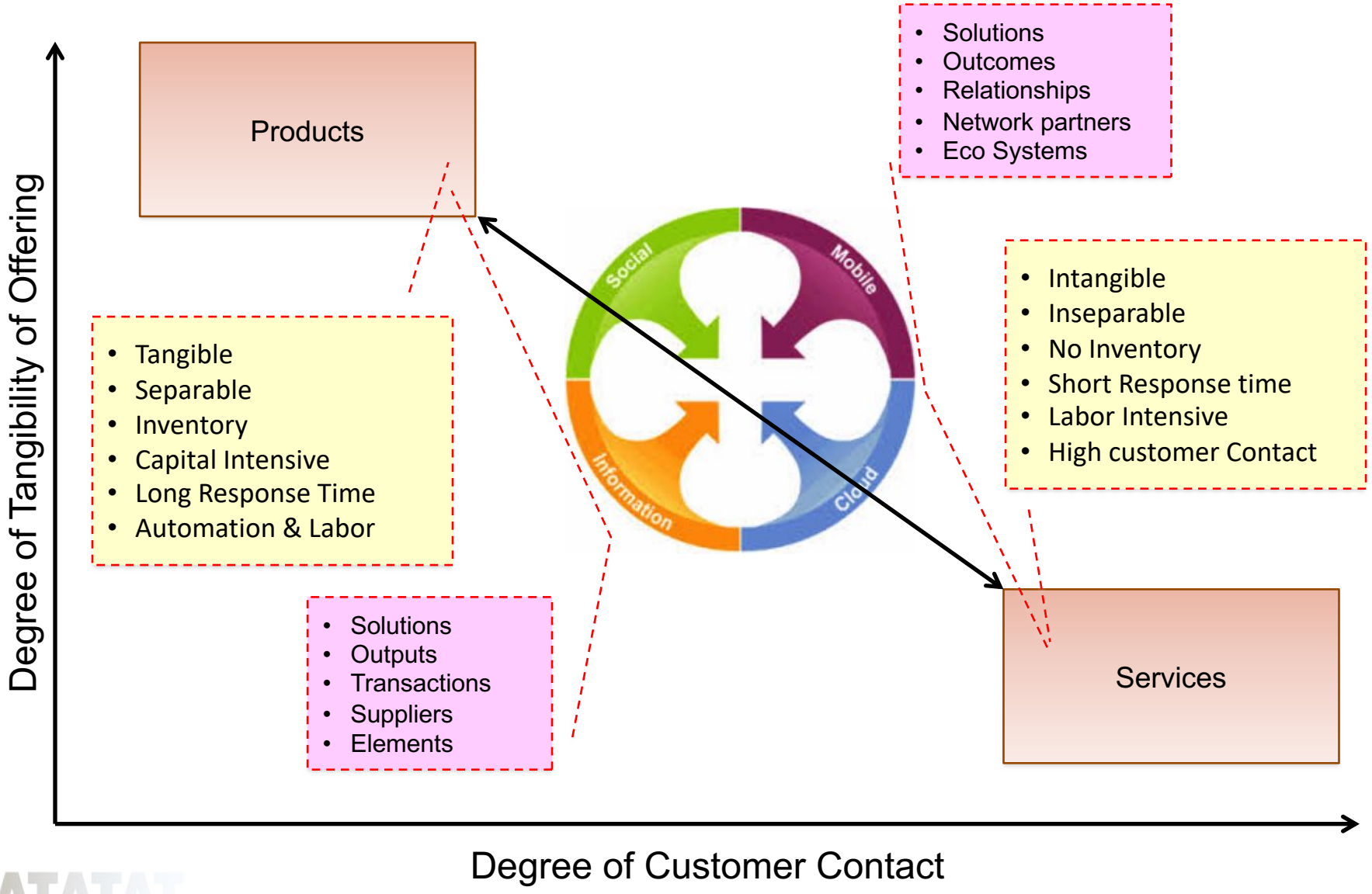
Disruptive: A new product, service or idea that radically changes an industry or business

Digital Product-Service Systems



Characteristics Of Digital Product-Service Systems

Products

Tangible: Can be physically seen, felt, smelt or tasted
Inventory: Can be stored, saved, returned or resold
Standardized: Most of the times, available as a commodity
Has Form: Materialistic
Separable: Production is separate from consumption
Marketable: Has Demand (wanted by buyers)

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Services

Intangible: Cannot be physically seen, felt, smelt or tasted
Perishable: Cannot be stored, saved, returned or resold
Heterogeneous: Unique, Valid for that situation alone, Is not repeatable
Formless: Does not have a form or shape (Not materialistic)
Inseparable: Impossible to separate production from consumption

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Systems

Organized: Structure and Order
Interactive: Internal and External entities
Interdependent: Parts depends on other Parts
Integrated: Parts are tied together
Central Objective: Every system has a purpose
Evolving: Parts combine to create emerging properties

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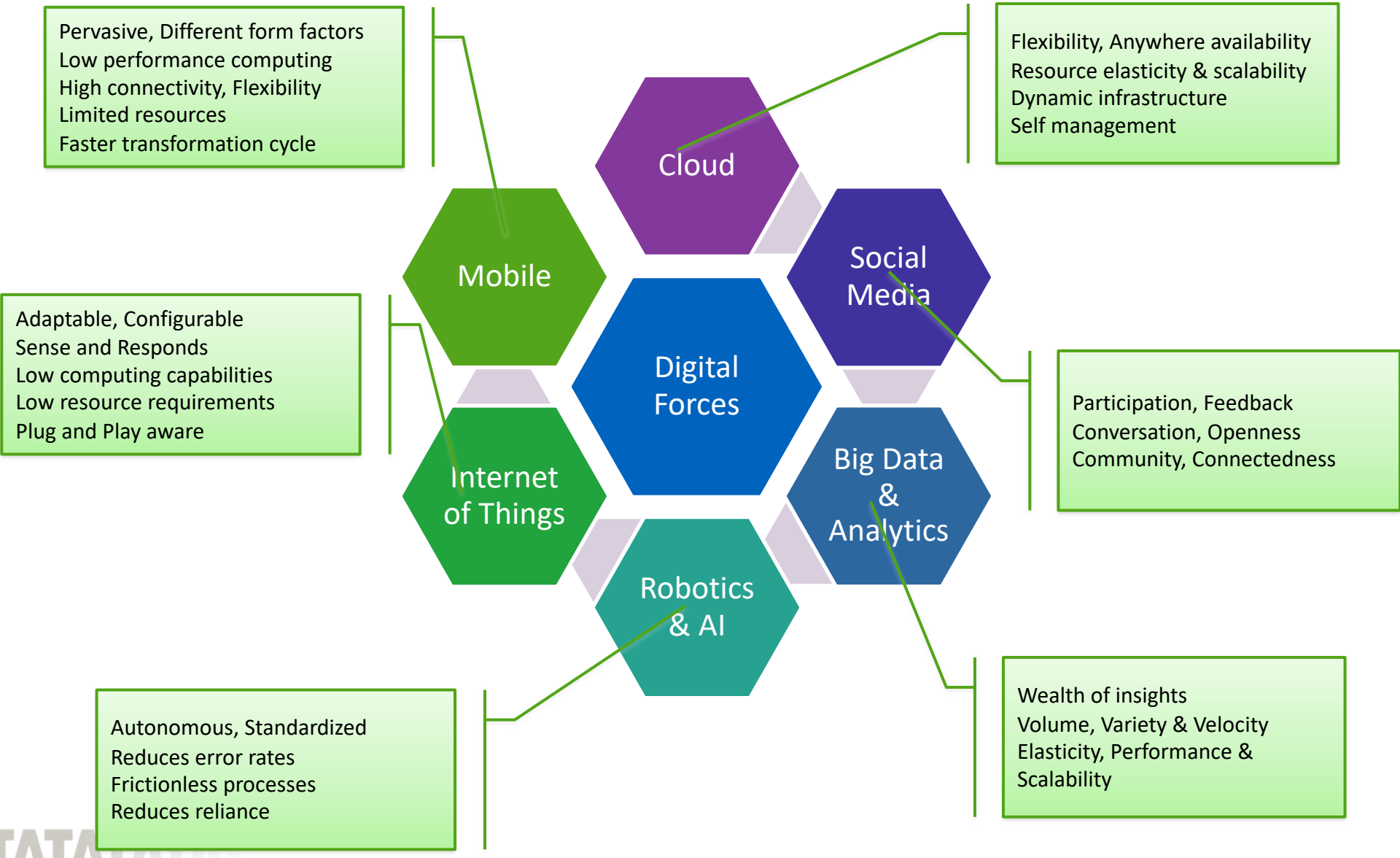
Digital

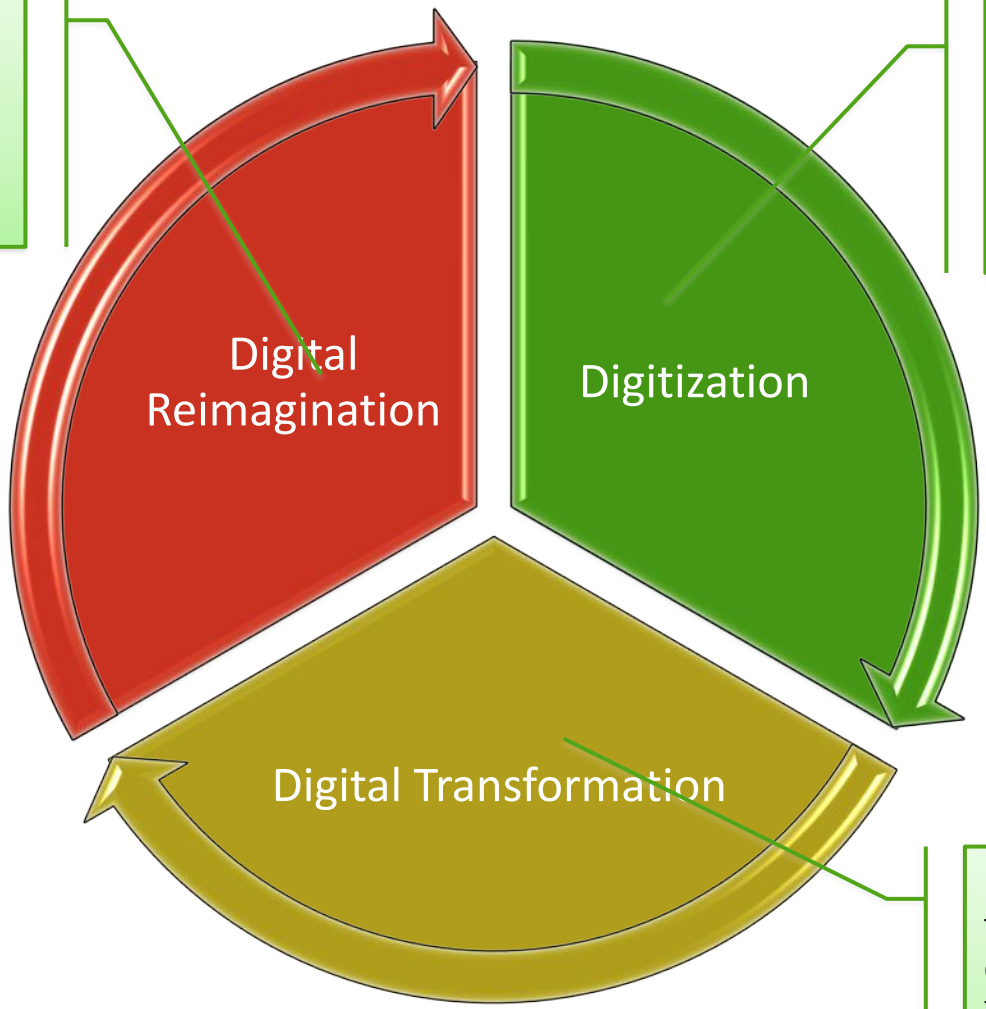
Formless, intangible, heterogeneous, pervasive
Ubiquitous, Agile, networked, distributed
Rich user experience, device independence & mobile
Real time intelligence, accommodates change
Highly responsive, Simple to create, Easy to Modify
Anywhere, anytime availability

Characteristics of Digital Forces



Digital Disruption Cycle

Bring in a fundamental change by introducing a new business model and appropriate digital product-service systems



Introduce digital technologies into a situation while preserving existing hierarchies, relationships, information flows, workflows, role players and interactions

Transform the experiences using digital technologies while focusing heavily on the stakeholder's purpose

Architecting Approach – Based on ISO/IEC/IEEE 42020:DIS

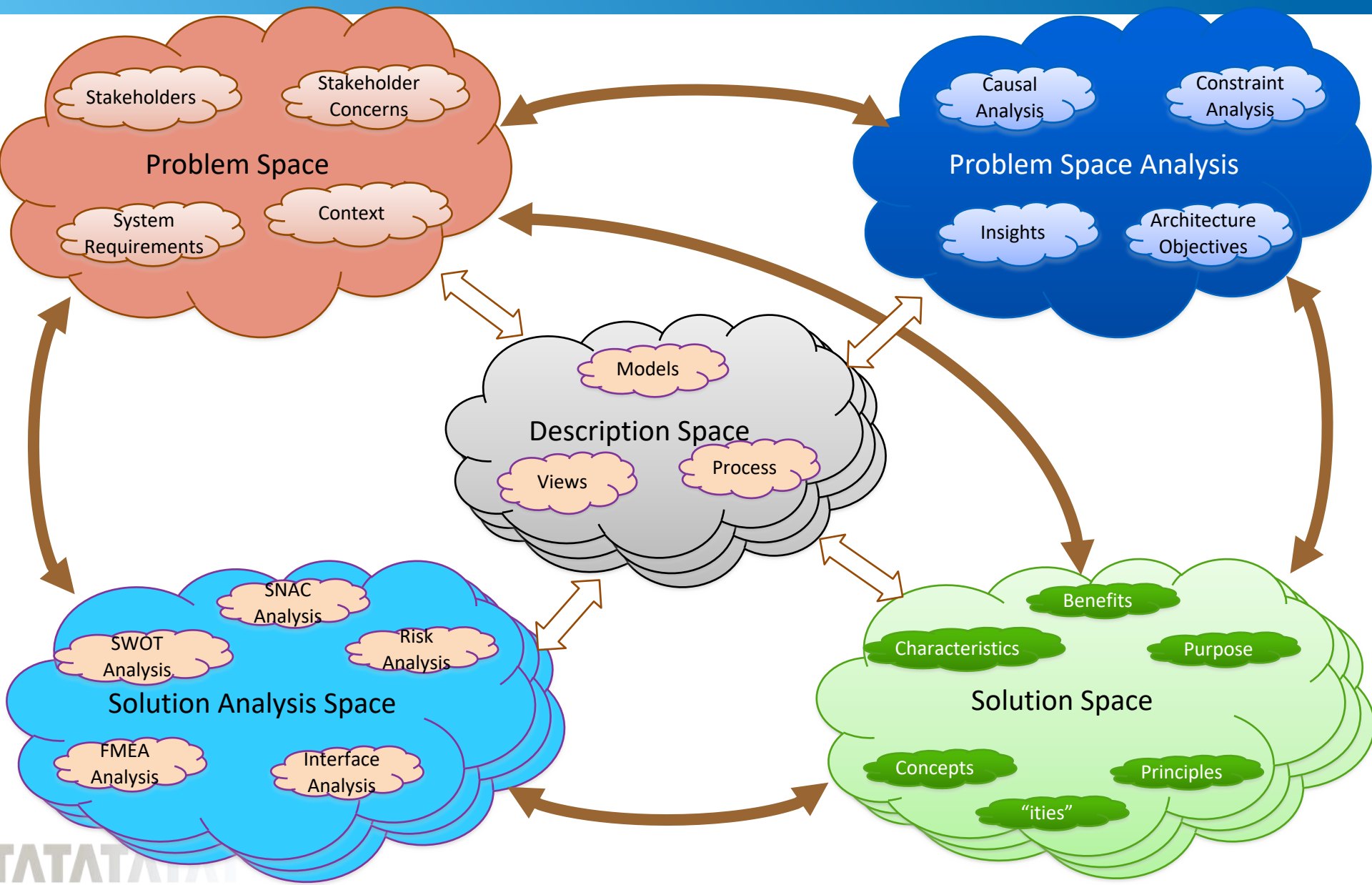


Illustration: Assisted Living

Background

- The aging community is increasing
  - Singapore (~900K by 2030)
- Old age support ratio is coming down
  - Lesser number of persons of working age (a factor of 1/3 by 2030)
- Aging-in-Place is a preferred practice
  - Live in own home and community safely, independently, and comfortably, regardless of age, income, or ability level
  - Participate in social, economical and cultural activities apart from the normal physical activities
  - Personal care to improve wellness and Health

Digital Disruption – Digitization

Guidelines and Principles

- **Digital devices are introduced to existing systems and processes**
  - Introduce digital technologies to existing situation is classified as Digitization
- **Preserve the existing hierarchy, relationships, workflows, information structures, role players, dynamics, and information flows**
  - Provide a new channel for interaction
- **Facilitate limited data mining of operational processes by establishing appropriate checks and balances**
  - Facilitate understanding of process performance, cost drivers and risk

Stakeholders

- Care takers (People being Observed)
- Care givers (Team of organizations and individuals)
- Community (Local organization of care takers)
- Sponsor (Who has concerns for the Care taker and pays for it)
- Government (Concerned about ageing communities)
- Service Providers (Different organizations providing different services)
- Suppliers (Different organizations providing different resources, supplies, infrastructure and equipment)

Stakeholder Concerns

- **Care taker**
  - Quality care
  - Less intrusion
  - More freedom and privacy
  - Timely intervention, if necessary
  - Dedicated care
  - Fast recovery
  - Active living
- **Care giver**
  - Quick detection
  - Early resolution
  - False positives
  - Right and timely intervention
  - Caring multiple care takers at the same-time
  - Clear guidelines and policies
- **Service Provider**
  - Timely information
  - Resource availability
  - Time to service
  - Success rate
  - Quality of Service
- **Supplier**
  - Resource availability
  - Timely information
  - Time to deliver
  - Quality of Parts
  - Volumes and Throughput
  - Frequency of Failures

Stakeholder Concerns

- **Community**
  - Aging in Place
  - Familiarity, Comfortability, Safety
  - Personalized care
  - Wellness and Health
- **Sponsor**
  - Quality of care
  - Quality of living of care taker
  - Assisted living costs
  - Timely intervention
  - Zero life-threatening incidents
  - Maintaining function
- **Government**
  - Preventing disability
  - Maintaining independence
  - Rehabilitation
  - Scale and Complexity
  - Infrastructure and related costs
  - Policies and Regulations
  - Right investments

System Requirements

- Auditability
- 24x7 Availability
- Multiple ways to sense wellness indicators
- Different levels of details (Minimum to Complete)
- Fail-safety and Redundancy
- Different kinds of alerts and notifications
  - Safe alerts to critical state alerts
- Historical information

Situation Context

- Health indicators for wellness established upfront
- Actual information obtained by examining care takers
- Different information kinds/types captured and transformed
- Sensors are intrusive or non-intrusive based on the health indicator
- Specialized equipment require trained technicians
- Lag health indicators captured after something has occurred
- Real-time health indicators captured while something is happening
- Lead health indicators established based on historical data
- Captured information is used to identify wellness levels

Value Proposition

Beneficiary	Benefit
Care taker	1) Meaning and Contentment in Life 2) Care without any expectation 3) Sense of being needed, cared for and wanted
Care giver	1) Excellence in caring 2) Satisfaction in service 3) Knows exactly what to do in any situation
Sponsor	1) Personal satisfaction 2) A healthy, full-life, with minimum disruption
Service Provider	1) Elevation above the competition 2) The smartest way to health service
Supplier	1) Knows exactly what to provide and when 2) No tech headaches and hurdles
Community	1) Turning lives around 2) Healthier with less effort
Government	1) Elderly health care without the hassles

Purpose

- Monitor wellness using devices of different form factors
  - Capture health indicators non intrusively
  - Generate notifications and alerts

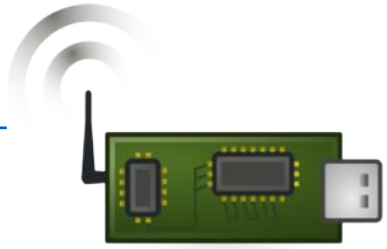
Quality Characteristics

- Integrates different kinds of sensors of varying form factors
- Collects data of varying complexity
- Collects data in real-time based on different sensor configurations
- Transforms, processes and analyses mined data in Real-time
- Generates real-time notifications and alerts based on different criteria

Concept Maps

Sensor

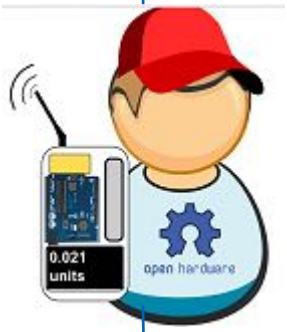
Sensor



Sensor

Elderly

Sensor



Sensor

Sensor

Notification & Alerts

Monitoring System

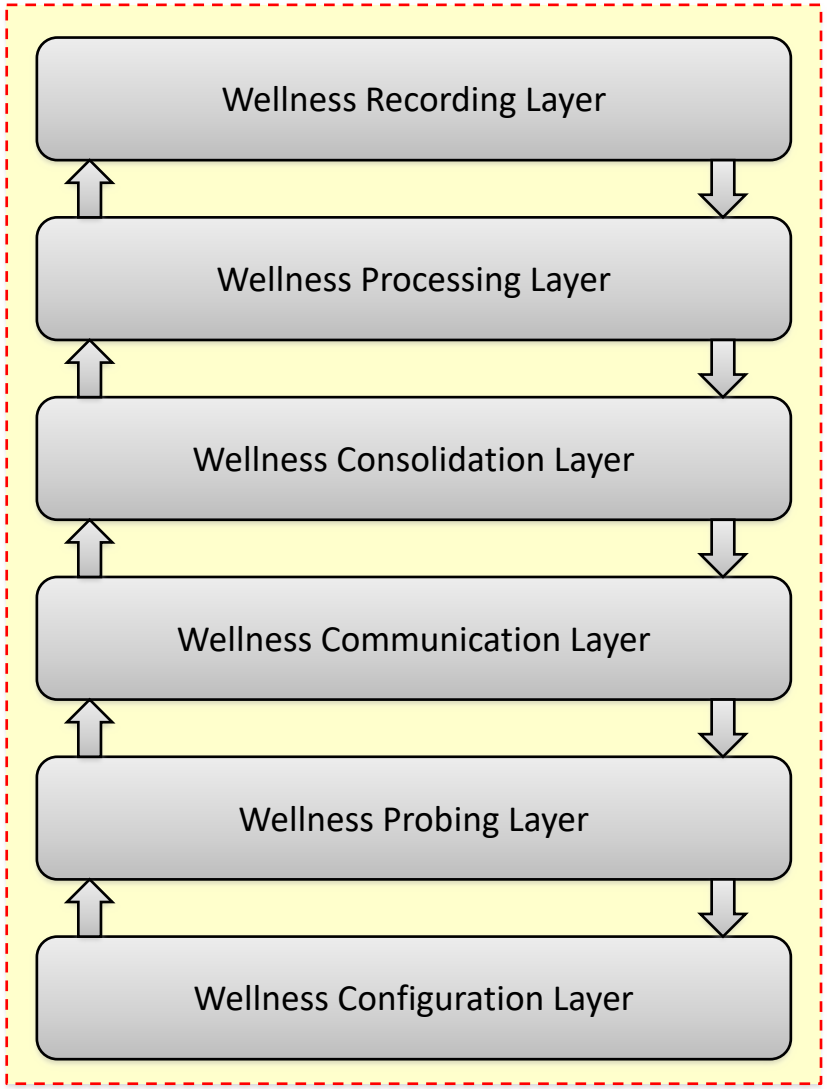
Principles

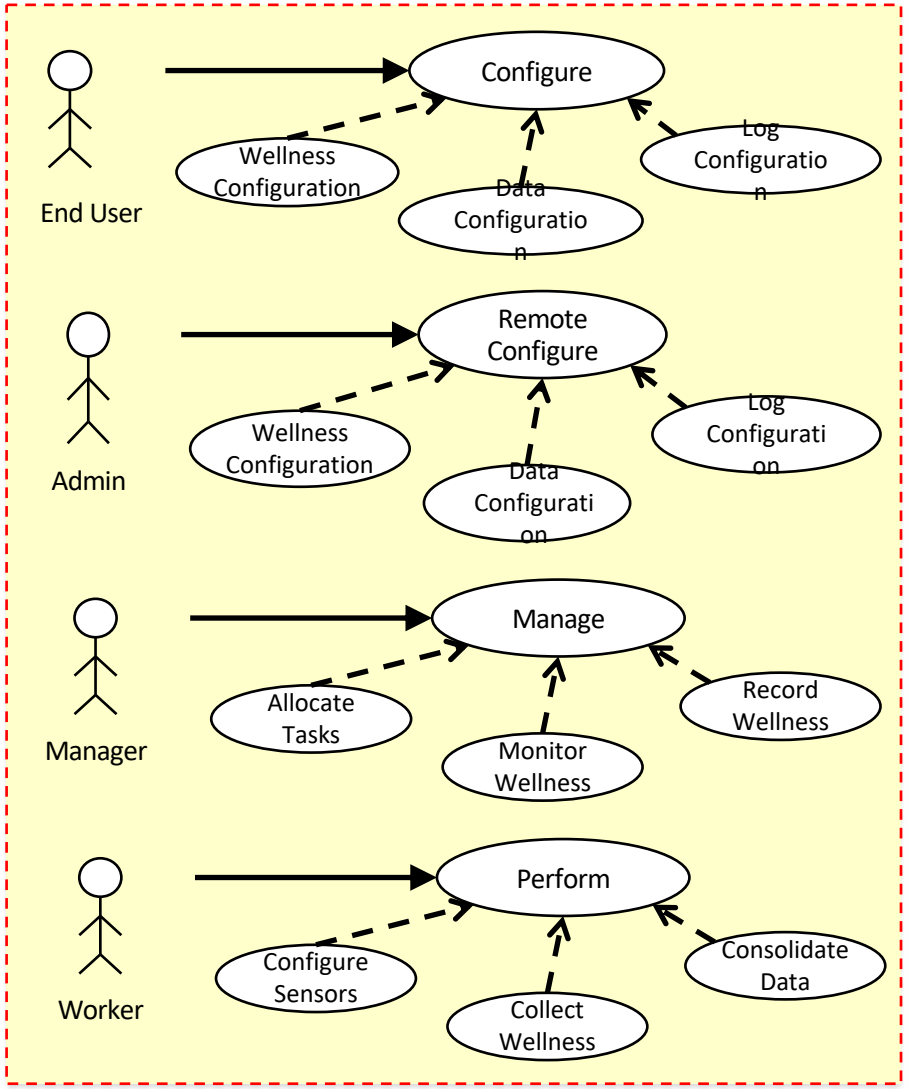
- Wellness is determined by analysing multiple wellness indicators
- Every individual has a specific configuration of wellness indicators
- Only simple indicators can be measured non-intrusively
- Indicators that require intrusive measures, needs human intervention

Functionalities

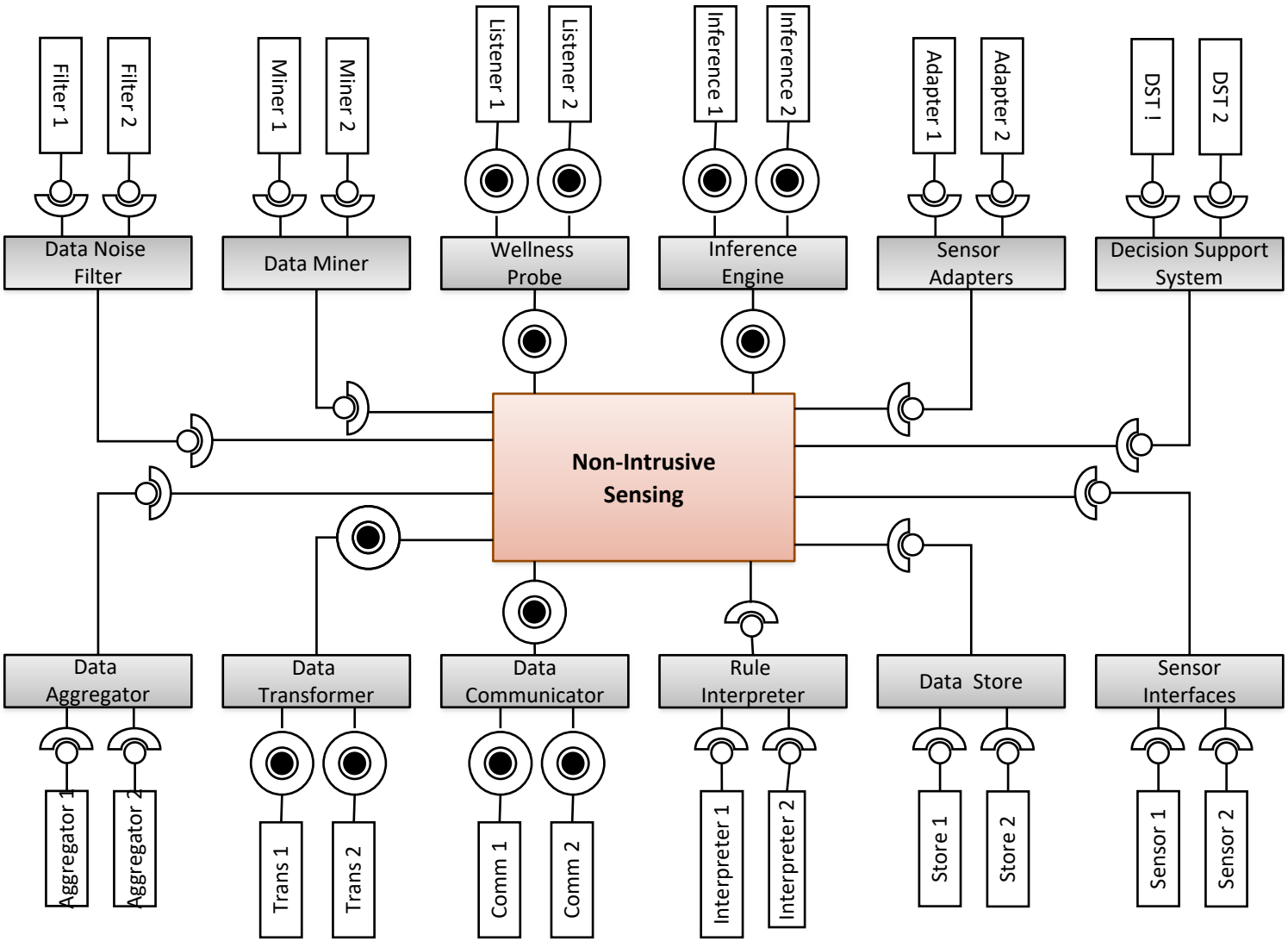
- Multiple wellness indicators contribute to overall wellness
  - Indicators span multiple dimensions
  - Indicators are of varying complexity
- Indicators measured using multitude of sensors
  - Each sensor can be configured in multiple ways
  - There exist multiple control factors for each sensor
  - Sensors are of varying complexity
- Sensory data integrated in real-time
  - Based on different rules and criteria
- Sensory data transformed in real-time
  - Based on different rules, formulae and criteria

Layers View


Wellness Recording Layer
Wellness Processing Layer
Wellness Consolidation Layer
Wellness Communication Layer
Wellness Probing Layer
Wellness Configuration Layer


End User
Configure
Wellness Configuration
Data Configuration
Log Configuration
Admin
Remote Configure
Wellness Configuration
Data Configuration
Log Configuration
Manager
Manage
Allocate Tasks
Monitor Wellness
Record Wellness
Worker
Perform
Configure Sensors
Collect Wellness
Consolidate Data

Structures – Components View



Digital Disruption – Digital Transformation

Guidelines and Principles

- **Transform the interface to the customer by using digital technologies**
  - Establish a new channel between the customer and the producer
- **Take a customer centric approach to understanding the needs and behaviors**
  - Move from product centric (I have all these offerings with these set of capabilities, decide what you want) to customer centric (This is your business, this is how my offering enhances your business)
- **Focus on the intent of the customer rather than the purpose of the offering**
  - Define the broader context within which interaction occurs
  - Focus on the end-to-end customer experience rather than touchpoints

Requirements

- Personalized care
- Personalized interventions
- Personalized instruments
- Personalized indicators
- Prediction, Prevention & Pro-activeness
- 24x7 availability

Situation Context

- Every individual is different and has different wellness and health needs
  - Its not about the wellness indicators
  - Its not about the underlying sensors
  - Its not about monitoring & measuring
  - It is about assuring the quality of life

- Every individual has personalized care needs
  - Each have personalized health and wellness scorecard
  - Each have personalized configuration items
  - Each have personalized interests
    - A person who is not diabetic, is not interested in their sugar levels
    - A person with parkinsonism, needs to be handled differently
  - Interventions vary and are personalized too

Value Proposition

Beneficiary	Benefit
Care taker	1) Empathy & Assurance 2) High quality experience 3) Personalized care
Care giver	1) Excellence in caring 2) High quality service
Sponsor	1) Zero incidents 2) Zero catastrophes 3) Affordable solutions
Service Provider	1) Zero lapses 2) Scalable business
Supplier	1) Continuous demand 2) Non linear growth
Community	1) Quality of life
Government	1) Elderly health care without the hassles

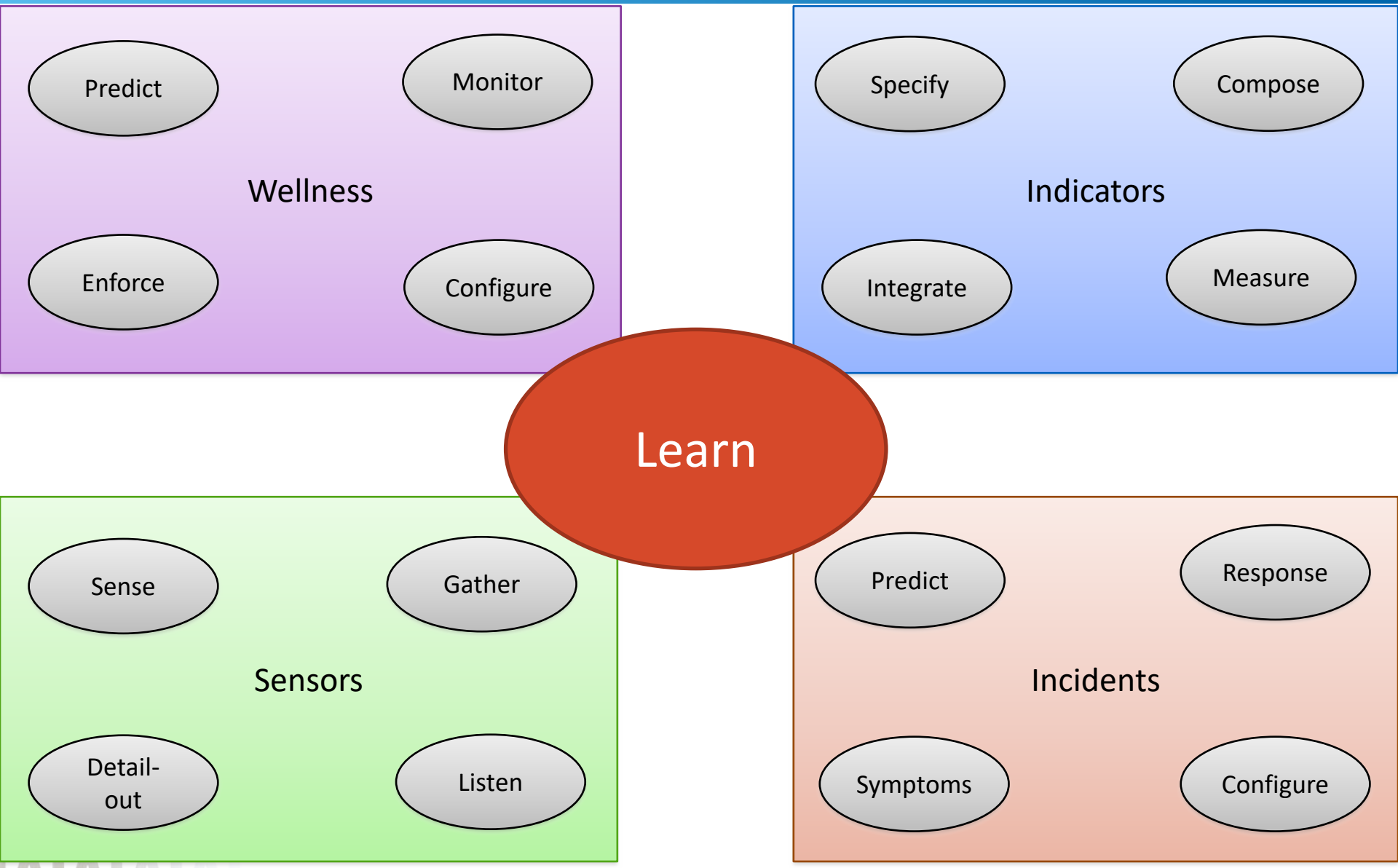
Purpose

- Virtual care giver
  - Personalize, Probe, Predict, Prevent incidents
  - Empathize, Enhance, Energize individuals
  - Assure, ascertain, assist human care givers

Quality Characteristics

- Integrates different kinds of predictions
- Integrates different kinds of indicators
- Integrates different kinds of sensors
- Integrates different kinds of analytics
- Mix & match all the above ➔ Personalization

Concept Maps



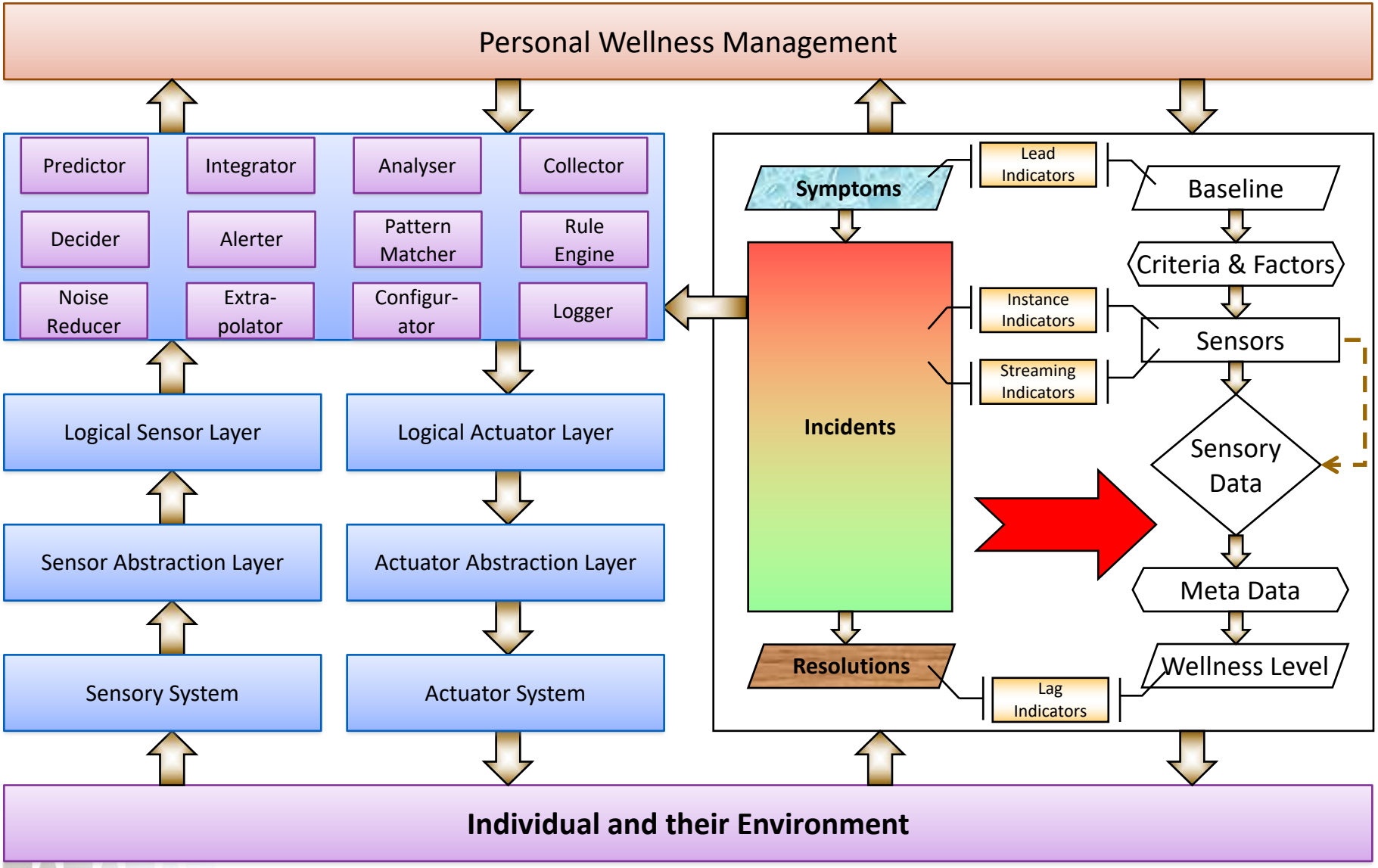
Principles

- Wellness is a function of wellness indicators
- Indicators are measures of wellness levels on different dimensions
- Incidents are triggered by specific wellness pathologies
- Wellness pathology is a specific configuration of indicators
- Sensors measure one or more wellness levels

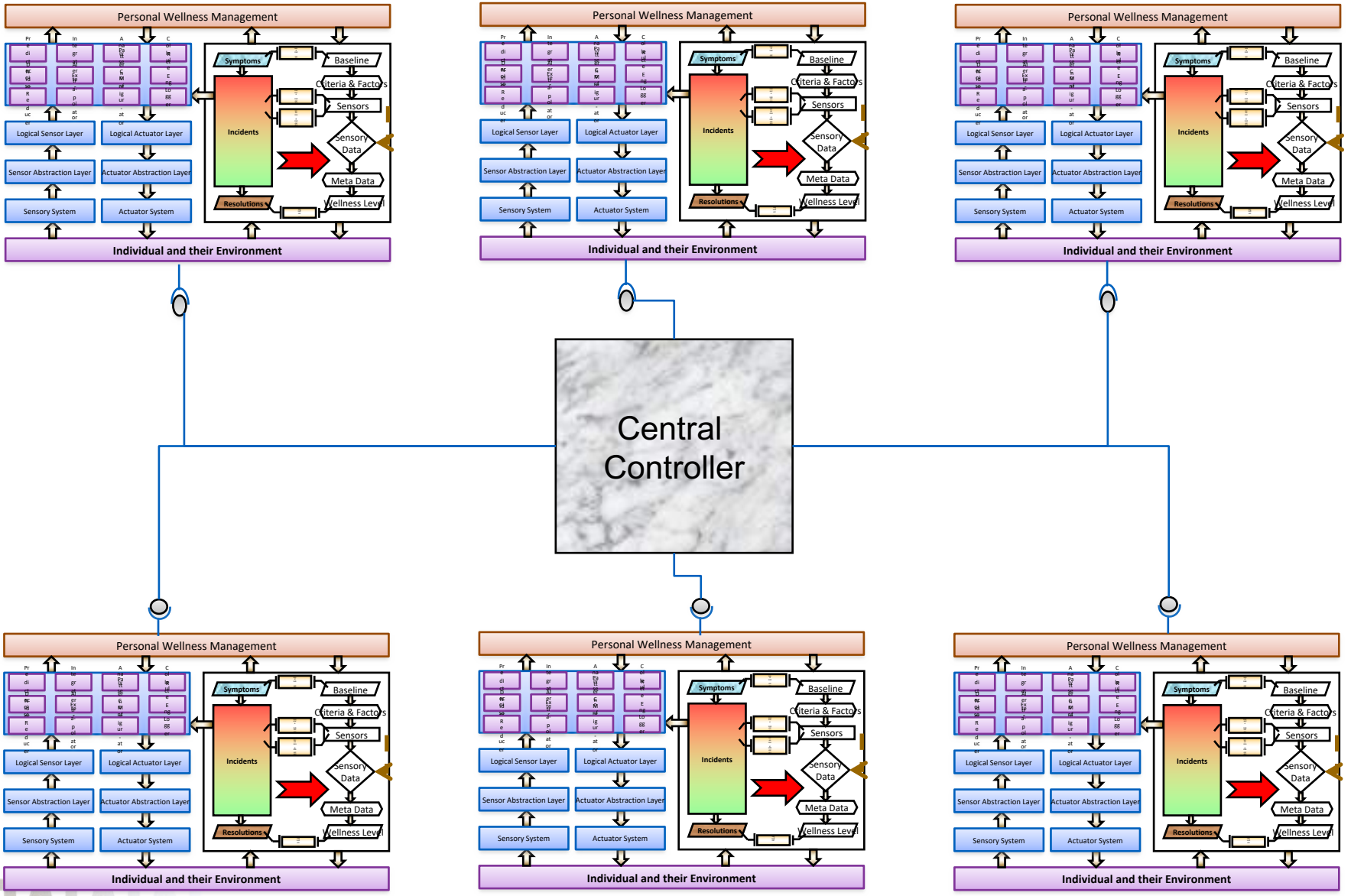
Functionalities

- Sense environment
- Sense wellness indicators
- Configure related sensors
- Identify catastrophic incidents
- Configure criteria and factors
- Map incidents to wellness indicators
- Configure wellness configurations
- Analyse and Predict futuristic incidents
- Analyse and Predict wellness failures
- Analyse and specify recovery path
- Analyse and specific possible interventions
- Specify ideal conditions and tolerances
  - Could be environment, sensors, wellness indicators, incidents…
- Maintain ideals conditions within specified tolerances

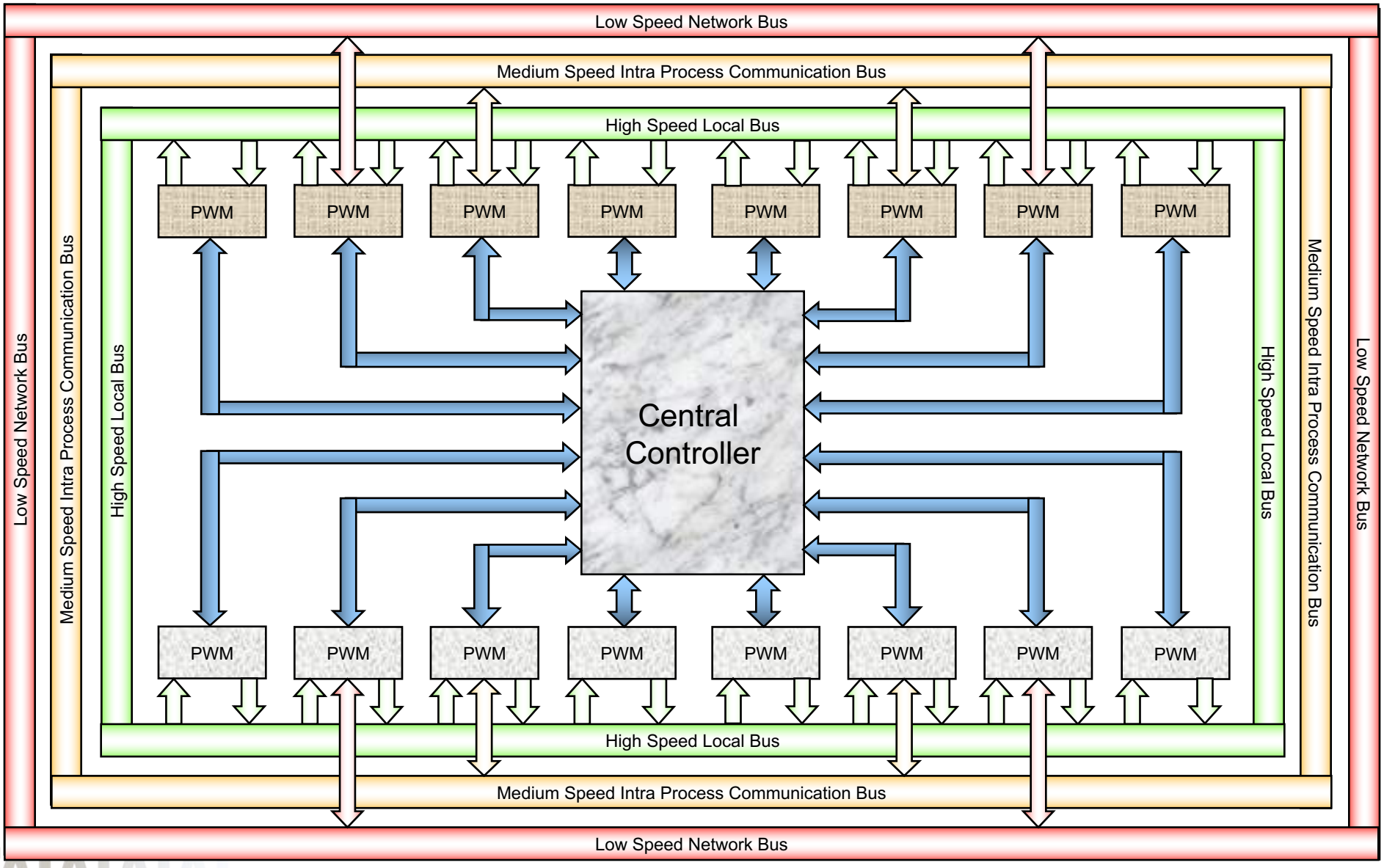
Individual View



Subscription View



Integration View



Digital Disruption – Digital Reimagination

Guidelines and Principles

- **A fundamental change is brought about by the use of digital technologies and an appropriate business model**

- **Create something new that is not simply incremental**
  - Leverage combination of digital forces
  - Reimagine different areas
    - Business Models, Offerings, Customer Segments, Channels, Work place, Business Processes

- **Bring a new business model to market with associated digitally enabled products and services**
  - Fundamentally change many aspects of traditional wisdom
  - Focus on Customer Delight, Customer Satisfaction and Customer Experience

- **Facilitate change (upgrade/troubleshooting) whilst operating**
  - Connect to end customers, monitor the way they work, perform real-time analytics and fine tune the offering

Business Goals

- Empathy driven Society, Markets & Offerings
- Senior care and assistance taken for granted
- Businesses competing on empathy for elderly
- Industry benchmark for empathy

The Core Idea

- Business on Empathy for Elderly
  - Service Provider
  - Solution Acquirer
  - Service Aggregator
  - Product-Service Systems Provider
  - Solution Provider
  - Equipment Supplier
  - Capability Provider

Digital Reimagination - Business Model 1

Key Partners

- Elderly
- Sponsors
- Hospitals
- Care givers
- Service providers
- Infrastructure providers
- Suppliers
- Investors

Key Activities

- Hiring virtual care givers
- Monitoring elderly
- Monitoring environment
- Alerting and notifying hospitals

Key Resources

- Technology
- Infrastructure
- Health history
- Skilled Care givers

Value Proposition

Elderly:
- Flexibility
- Non intrusivity

Sponsors:
- Low costs
- Assured care

Service Provider/Suppliers:
- Repeat business
- Non linear growth

Customer Relationship

- Individual
- Community
- Government
- Customer

Channels

- Hospitals
- Doctors
- Social Media

Customer Segments

Individuals:
- Those who don't want to be dependent
- Those who want to care for their elders

Hospitals:
- Personalized setup

Community:
- Those want to age in their familiar environment

Cost Structure

- Technology, Infrastructure, Services, Supplies, Equipment, Sensors
- Development, Maintenance and operation costs

Revenue Streams

- Incident based pricing
- Time based pricing
- Consumption based pricing

Digital Reimagination – Business Model 2

Key Partners

- Service providers
- Hospitals
- Suppliers
- End Users
- Sponsors

Key Activities

- Customer Acquisition
- Customer Servicing
- Customer Retention

Key Resources

- Customer wellness patterns
- Wellness data
- Sensory data

Value Proposition

Customers:

- Empathy Experience
- Customized Assistance
- Quality of life

Partners:

- Consumption based payment
- Profitability
- Repeat business

Customer Relationship

- Social Media
- Customer Support
- Review, rating & feedback system

Channels

- Web
- Mobile
- Network
- Devices

Customer Segments

Users:

- Elderly
- Families

Partners:

- Service provider
- Hospitals
- Suppliers

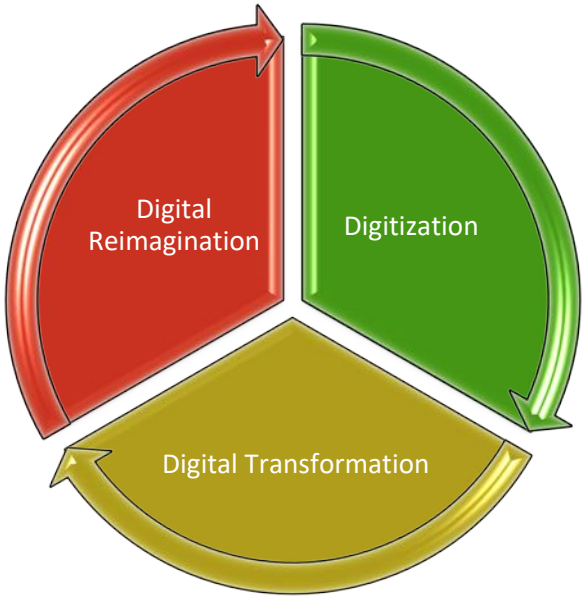
Cost Structure

- Service Expenses
- Supplier Expenses
- Networking Expenses
- Diagnosis Expenses
- Hospital Expenses

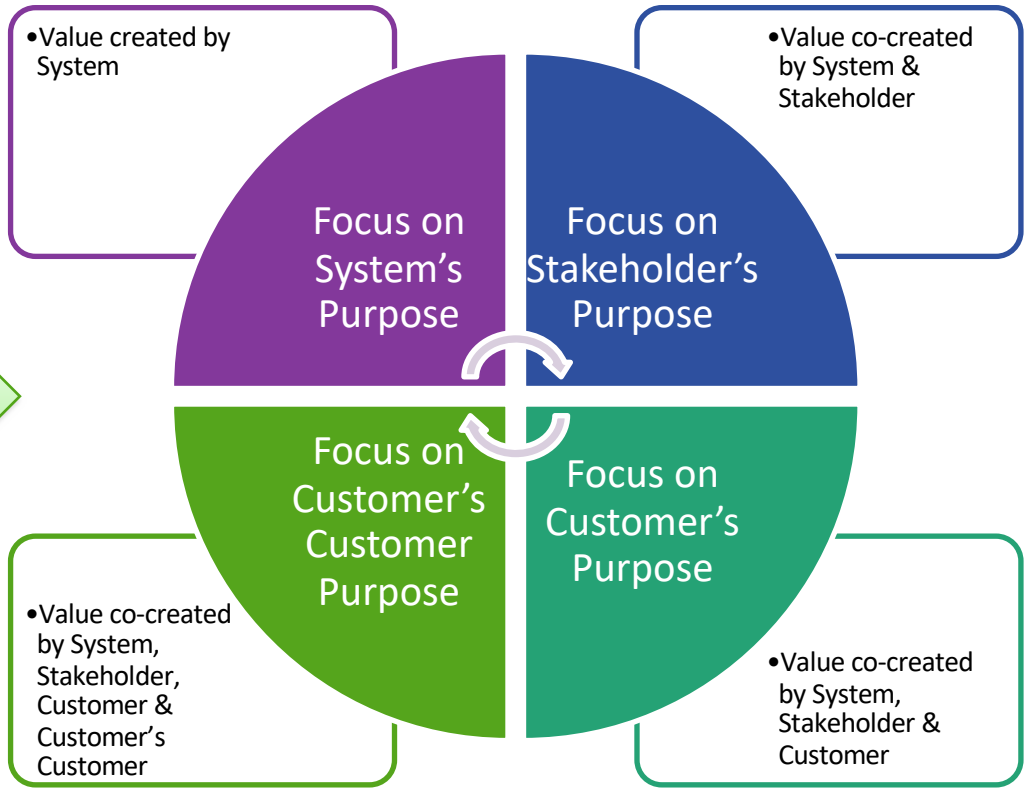
Revenue Streams

- Pay as you use
- One Family One Plan
- Personalized pricing plan
- Subscription

Summary



Digital Disruption Cycle



Moving up the Value Chain

Thank You