Executive Summary

The global population is aging rapidly, presenting healthcare organizations, governments and the general population with immense challenges, with economic sustainability at the top of the list.

Technology advancements in Information and Communication Technology (ICT) may be able to help countries and governments overcome this challenge. We believe an open end-to-end information platform that can draw in multiple parties, integrating data and services, can help satisfy diverse needs for the aging population, like improving service cost efficiency and bringing virtual care experiences to the home and community.

In this white paper, as a reference to the open end-to-end platform, we proposed a smart aging independent living (SAIL) solution that helps promote intelligent, personalized care. Designed specifically for the aging, the SAIL device acts as the unified service hub and intelligent gateway, connecting various sensors, wearables and other medical devices. The SAIL cloud enables data sharing and Application Program Interface (API) management for optimized development of various aging applications and services.

This white paper will also introduce the proof of concept work done around the SAIL solution in collaboration with VSI, a local aging IT solution provider. Our vision is to build an open end-to-end information platform for the aging service industry, helping them realize an economically viable aging service model.

Introduction

A 2002 year report by the United Nations predicts that the global aging population, ages 65 and above, will be 1.457 billion in 2050, 15.6 percent of the total global population. In 2014, China had 138 million people ages 65 or above, which made up 10.1 percent of the total population, making it the only country in the world with an aging population of over 100 million. By 2050, that number is expected to be more than 300 million, making up 21.4 percent of the population. The high rate of growth among the aging population in China exceeds the average growth rate of all other countries around the world.
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Economic sustainability is the fundamental problem for the whole senior care industry. The institution-based care model, where the aging population is collectively cared for in nursing homes and aged-care centers, comes with substantial costs. In 2014, only 24.4 out of 1000 people in China could enjoy the care service provided by an institution. The average construction cost of a nursing bed in Beijing, including land requisition, construction and labor costs, has reached nearly 550,000 CNY (Chinese Yuan)\(^3\). What’s more, a large portion of the aging population prefers to stay at home or remain living in their community with some level of independence. According to a survey conducted by China National Committee on Aging (CNCA) in 2010\(^4\), the ratio of urban seniors who won’t choose the institution-based care model was 88.7%, and the ratio among rural seniors was 87.5%.

The implementation of the basic National Policy for Family Planning and the economic and social transformations, have made smaller family sizes, and a “4-2-1” family structure (four older people consisting of parental and maternal grandparents, two parents and only-one child) increasingly more common, making the traditional family members-provided care model a poor option for China.

China has made great strides in an effort to enable a healthy and independent lifestyle for the aging population. The Chinese government is now encouraging the implementation of an aging service system through Public Private Partnership (PPP). To fully motivate and support private sector engagement, an open end-to-end information platform is required, so that multiple providers can work together to provide aging services that deliver improved quality at lower costs.

IT Infrastructure Demand for Aging in Place

As the aging population continues to rise, the impact can be felt financially in soaring costs related to funding pension, medical care and other aging services. With a lack of social resources to meet rapid growth, the Chinese government is actively developing a new social care service system, described as “a home-based community supported by institutional backing.”

The goal is to have 90 percent of the aging population receive home-based care, with 7 percent receiving community-based care, and 3 percent receiving institutional care. While this is seen as a viable solution, it is still in the planning stage, with a number of issues that need to be addressed before we can facilitate an effective aging-in-place model of care.

Satisfying Diverse Aging Service Needs

Services required by the aging population are diverse. In addition to daily living care, there are also needs for healthcare, social communication, learning, entertainment, leisure and feelings of worthiness. At different stages of the aging process, the needs are different and often change quickly due to milestone events, like the death of a spouse.

There are also gaps in socioeconomic status and lifestyle behaviors among different regions, as well as an individual’s health status, spending power, life experiences and perceptions on aging services, leading to complexities in aging service requirements.

To satisfy a wide range of aging service needs, a flexible solution that offers a variety of service offerings from multiple providers and partners, can help improve care deliver efficiency and reduce costs.
Improving Service Cost Efficiency

One of the biggest gaps for community and home-based care is the insufficient number and quality of “home care personnel.” Service personnel are often overworked and most of them are untrained, improving work efficiency and productivity help deliver better quality of care and lower costs. A variety of digital technologies have already demonstrated their capabilities in increasing caregiver work efficiency. For example, with various sensors like the fall detector, caregivers can monitor the older people continuously, saving time and resources associated with repeated visits and helping them use their time more effectively.

A platform should enable those digital solutions to run smoothly on top of it, while also connecting service personnel with a broader spectrum of older people. This will help reduce costs and promote productivity. If a caregiver can reach more people who live close by, they don’t need to waste time travelling from one place to another, they can integrate the various demands and make full use of their time by treating a larger number of older people.

Bringing Virtual Care Experiences to the Home and Community

Many local governments in China have constructed call center systems for older people who live in neighborhoods within their jurisdiction. The call centers handle incoming calls first and then transfer the service requests to certified service providers. The aging service is ultimately delivered as normal and is not fundamentally changed by the call center system.

Virtual care is a care delivery model that describes a set of online ways of caring for the aging, empowering them to manage their own care and live more independently. Compared with traditional care delivery models, virtual care is more economic and has huge cost-saving advantages compared to staying at an expensive hospital or nursing home. Advancements in technology has enabled the virtual care model to become a reality. For example, lots of smart devices with sensors are capable of measuring and monitoring physiological and psychological data. With the data communicated to the caregiver or health management professional, various active services like early diagnosis and detection, preventative-care and care related information provision can be delivered via a myriad of technology solutions.

Construction of an End-to-End Open Information Platform

In order to provide the aging population in China with the personalized services they need, in a cost-effective and highly qualified way, an end-to-end open information platform needs to be implemented.

Openness of the Platform

One of the key characteristics of this information platform that meets the aforementioned demands for aging in place is its openness. The “openness” of the platform is mainly reflected in the following characteristics.

- The ability to attract diverse partners

An open aging service information platform should be able to attract a wide array of service providers, matching demand with the supply of service. The open platform helps older people to find appropriate service providers that would otherwise be unreachable offline, and service providers have the opportunity to serve more end users: in this way, service costs can be reduced through increased service accessibility.

- Data sharing and open access to data analytics services

The open sharing of aging service data and the provision of resources and tools for data analytics are crucial for the open platform to connect relevant stakeholders in the aging service market, thus enhancing the integration and cooperation of the industry chain and enable it to collaboratively provide innovative services and products.

- Clear benefit-sharing model

The open platform itself should support a flexible and diverse charging model, like the service membership subscription model, service call charge and product direct selling model. The role of the payer can be played by different stakeholders, such as older people, their family members, local government, certain NGOs, or aging service providers with product advertisement or promotion requirements. No matter what business model is applied, the platform should have a clear and fair benefit-sharing model to
ensure cooperative development and a win-win situation for all partners.

**End-to-End Structure of the Platform**

There are already a lot of “one-off” products in the aging service market, but what’s needed are solutions that deliver a complete range of services, so the patient doesn’t have to get a new system for each service they need.

The open information platform can help to integrate various aging service resources, but unless it’s truly end-to-end, which means the platform includes both the client and backend components, it will not meet all of the requirement of the various stakeholders. An end-to-end open platform is comprised of the following three core elements:

— An open age-friendly device that acts as an integrated access portal for different aging services
— An open gateway, responsible for collecting data from different types of smart devices or sensors, processing them in real time and transferring them to the back-end data center
— An open data platform, making relevant aging service data available to third party service providers and support third party data input to the platform

Figure 2 describes the general usage of the open platform. Older people can use a terminal device to access a wealth of aging services or related applications. The usage data, and the data collected by smart devices or sensors, will be collected and transferred to the back-end data center.

The aging service related data can be more effectively used through sharing and exchanging with various service providers. For example, a daily life service provider can recommend food that can change according to health condition data; the bed motion sensor data can be shared to a health service provider so that different guidelines can be provided to the aging patient, based on their particular condition. In addition to using the data for customized services or applications, the data can also be shared with the government for better management and policy making, to the research institute for aging research and to the service providers or product makers for business insight like quality and efficiency improvement.

**A Reference to the Open Platform: the SAIL Solution**

On May 17th, 2012, Intel launched the Age Friendly Communities Initiative in China, collaborating with several ecosystem players to define a specific solution that demonstrates how the open platform supports smart aging for independent living. This solution, which we call SAIL, includes the SAIL device (with gateway features) and the SAIL cloud.
**SAIL Device**

With the continuous improvement of information technology and the popularity of mobile devices, older people can request services not only through the traditional call center, but also access rich services through the specialized service terminal. This specialized service terminal can be provided by the aging service platform operator as the unified service hub.

The SAIL device includes two parts: the SAIL tablet and the docking station (see Figure 4).

The SAIL tablet plays as an entrance to aging services. It is a touch-based age friendly device designed for the elderly to help them discover and enjoy personalized aging services. Table 1 shows some age friendly design features of the SAIL tablet.

Age friendly design can not only win the user viscosity, but also attract more application developers to develop age friendly applications or services. Rich applications will help deliver a better quality of life for the elderly and will further increase aging service terminal usage and achieve a virtuous circle.

The docking station not only provides a simplified way of “plugging-in” and “charging” the SAIL tablet, but also acts as an open gateway to interconnect different devices, such as wearables, home medical devices and other aging service sensors or monitors etc.

The main user experiences of the SAIL device include:

- Broad and tailored aging services that are personalized or suited to the user’s own personal needs
- Barrier-free interaction mode
- Full service flow support
- Connected with service agency and with personal social circle at any time and in any location
- Connectivity to other sensors or devices

**SAIL Cloud**

Opening data access and provision of development tools is the key to attract various partners to collaboratively provide high quality and cost-effective aging services. The SAIL cloud enables faster development cycles for independent software vendors (ISVs) and service providers (SPs), mainly through data security and data analytics services, the SAIL client software development kit (SDK) and API management tools.

- **Data Security and Analytics**

Health and behavioral data inevitably involves a large amount of confidential information, disclosure of this information could cause them to encounter unwanted intrusion into their daily lives. In addition to the privacy protection issues, security threats and possible data corruption may also include impersonation, content tampering, hacking and viruses. Intel Security and McAfee provide various solutions with vertical integration of security software and security hardware.

Once high volumes of various aging service related data are captured, achieving the anticipated insights remains an elusive challenge. The
### TABLE 1 SAIL AGE FRIENDLY DESIGN FEATURES

<table>
<thead>
<tr>
<th>AGE FRIENDLY DESIGN PRINCIPLE</th>
<th>SAIL UI FEATURES</th>
<th>ILLUSTRATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple</strong>&lt;br&gt;Simple content structure and interactions</td>
<td>Only 3 interaction gestures: click, swipe, zoom in and out</td>
<td><img src="image1.png" alt="Illustrations" /> <img src="image2.png" alt="Illustrations" /> <img src="image3.png" alt="Illustrations" /></td>
</tr>
<tr>
<td><strong>Consistent</strong>&lt;br&gt;Consistent navigation pattern for different services or applications</td>
<td>Lock screen as an information board showing most relevant information</td>
<td><img src="image4.png" alt="Illustrations" /></td>
</tr>
<tr>
<td><strong>Convenient</strong>&lt;br&gt;Let the older people easily access functions whenever they need</td>
<td>Services categorized on the home screen</td>
<td><img src="image5.png" alt="Illustrations" /></td>
</tr>
<tr>
<td><strong>Familiar</strong>&lt;br&gt;UI elements are familiar for older people</td>
<td>For various applications/services, the content structure and navigation structure is unified</td>
<td><img src="image6.png" alt="Illustrations" /></td>
</tr>
<tr>
<td></td>
<td>Social communications always available for&lt;br&gt;• Bridged use with the help of their children or local platform operators&lt;br&gt;• Communications with service providers&lt;br&gt;• Communications with family and peer friends</td>
<td><img src="image7.png" alt="Illustrations" /></td>
</tr>
</tbody>
</table>

**ILLUSTRATIONS**

1. Navigation bar of the application
2. Content area of the application
3. System menu bar

**White Paper** Building an Open Information Platform for Ageing Services: SAIL Concept and Pilot in China
SAIL cloud deploys Intel data analytics solutions for data scientists and aging application service developers to build and operate domain-specific applications driven by data analysis at scale. With the Intel Analytics Toolkit, data scientists and developers can orchestrate and easily iterate through the end-to-end analytics workflow in a single program, using a familiar programming language that executes analytics using fully scalable algorithms.

- **SAIL Client SDK with Incorporated Context Sensing**

  The SAIL client SDK optimizes the development of rich services or applications for aging populations. With the SAIL client SDK, third-party service creators and application developers don’t have to be concerned about infrastructure-related matters and can gain access to various development tools and even an integrated development environment.

  Context-sensing capabilities are incorporated into the SAIL client SDK, enabling developers to easily create context-aware applications/services that run on the SAIL device. The context-sensing SDK includes Context APIs and a Rules Engine. The Context APIs allow the developer to “sense” and “set/get” context states. The Rules Engine is a powerful way of creating rules based on context, in order to execute actions when the rule evaluation becomes true or false. With the context-sensing SDK, developers can rapidly provide customized aging services/applications: for example, an elderly person suffering from hypertension can get a service message when he/she goes outside and the outdoor environment is much colder than the indoor environment.

- **API Management Tool**

  Aging service related data, the data analytic toolkit and other SAIL client software development tools can be accessed by third parties through an open application programming interface (Open API) method. An API is a set of commands, functions, and protocols which programmers can use when building software. APIs can also package a specific set of data that helps developers ensure consistent data portrayal in an application, regardless of delivery method. It gives businesses the ability to use valuable information in greater context than it is collected, or to aggregate data within scenarios.

  The aging service platform operators, from their perspective, have a need, to know who is calling the API, to have better flow control of API traffic, to let more developers and partners familiarize with the open API and to ensure effective data security and open API reliability. API management tools can meet the above requirements, making it much easier to manage the open API as well as security and also gives the operators more flexibility to efficiently build, deploy, and update the API. SAIL cloud adopts MasheryTM as the API management solution.

**SAIL Cloud Pilot with iZhaohu from VSI**

In 2014, in order to demonstrate the feasibility of the SAIL solution and proactively explore its usage potential, Intel and VSI jointly implemented the proof of concept deployment of the SAIL cloud.

**Requirements for Transformation of iZhaohu from VSI**

Established in 2007, the Shanghai VSI Intelligent Technology Co. Ltd (VSI) provides senior care IT solutions. Relying on its own research and development capabilities, VSI developed a series of intelligent care hardware and software systems, called “iZhaohu”, for homed-based or institutional-based care for the aging population.

In order to further expand business, VSI will completely upgrade its technical architecture and transform the system into an open platform. The requirements are detailed in the following two parts:

![Figure 5 Mashery Deployment with iZhaohu](image-url)
To draw in third party hardware equipment manufacturers and software developers to provide more quality services to aging end users. Although some monitoring solutions have been provided for the elderly, VSI cannot rely on the hardware and software systems developed by just their own R&D capabilities to maximize user value. VSI transformed to open its technical architecture, introduce third party products and services, jointly develop the potential value of elderly people data so to maximize the user benefits and reach a win-win situation for all.

To satisfy various elderly monitoring and business intelligence demands from the service providers, care institutions, community and government, etc. Apart from the elderly and their families, the customers of VSI solutions also include service personnel (such as specialized care givers for home based and care institutions) and management (such as the management of care institutions and government monitoring personnel within the jurisdiction, etc.), all of whom have different requirements in terms of different levels of service, operational policy and monitoring measurements. These require VSI to have a comprehensive solution covering data integration, analysis and mining, capable of managing data extraction and analysis needs, setting different levels of data access, analysis and mining, and ensure data security and a unified and reliable service.

Implementation of API Management on the Cloud

Intel China’s Healthcare and Life Science department worked closely with VSI, gradually outlining the deployment strategy of iZhaohu data and capability. VSI then deployed Intel’s API management solution Mashery™ on the cloud. The deployment for the pilot took less than five working days to setup the servers and integrate them into VSI’s network infrastructure. After two days’ training and mentoring, VSI’s system administrator and application developer were able to configure the APIs independently. The average configuration time for one API is only about 1 hour. No change is needed on the VSI’s backend servers, and very minor changes in the client application code.

Currently the Shanghai Pudong Senior Care Business Development Center (hereinafter referred to the Center) has already accessed VSI’s open APIs for management and research purposes. The Center, attached to Shanghai Civil Affairs Bureau, is a public institution responsible for various aging research, event organization for enriching the aging people's life and management of municipal senior care institutions.

Summary of the Pilot and Future Development

By deploying the API management tool, VSI can make huge development cost savings, and even more savings on time-to-market, since time is money for companies in emerging markets. Besides the direct cost savings, Mashery™ can enable VSI to publish the APIs to 3rd parties, and it will also generate revenue from data sharing.

First, VSI opens APIs to offline aging service providers to enable them quickly building up the online to offline (O2O) capability.

Second, VSI opens data APIs to hardware equipment suppliers and establishes a broader cooperative partnership to fulfill elderly people’s multi-level requirements. iZhaohu data is attractive to many hardware equipment suppliers. For example, Blood Glucose Meter manufacturers can analyze the relationship between blood glucose test results and activity data, so as to make better judgments on how daily activities affect the accuracy of blood glucose tests and hence improve the quality and function of their products.

Third, VSI opens data APIs to research institutions and helps to build a health risk evaluation and intervention model for elderly people. For instance, Shanghai Huashan Hospital has shown great interest in iZhaohu data and its potential to assist their research into Parkinson’s disease.

Fourth, VSI opens data APIs to government regulators and receives financial support from government or welfare organizations.

Fifth, VSI opens data APIs to volunteers and other informal aging service organizations in order to make up for the inadequate number of aging service personnel. Some volunteer groups, social worker organizations and other informal elderly care service teams are working with VSI, but the personnel turnover in these groups is high, the organizations are often short-lived and their activities are sporadic. Fully utilizing informal organizations can reduce service costs. Opening data to volunteers or social worker groups can help them to ascertain, over time, the aging service requirements and to arrange groups, volunteers or individuals to provide a home visiting care service accordingly.

Conclusion

In order to address the vast and diverse aging service demand in an economically sustainable way, an open information platform should be constructed so as to expand the service scope to cater for a much higher percentage of the aging population, and to attract a broad spectrum and even cross-border service providers to enter the aging service industry. In this white paper, we propose the SAIL solution, which mainly involves an age-friendly SAIL device that acts as a unified service entry point and data gateway, as well as the SAIL cloud, which enables data sharing and
optimized development of various aging services and applications.

Through the proof of concept work with VSI, a local aging IT solution provider, we think the SAIL solution can bridge and benefit all stakeholders of aging service industry. For government and supervisory authorities, the SAIL solution can help them better execute the supervision and provision of policy guidance through data sharing. For the service providers, the SAIL solution can provide opportunities for them to reach out to more elderly users, enable highly efficient matching of demand and service supply, reduce costs and improve efficiency in running the service by getting a holistic data view that is centered round elderly people, crosses service providers and encompasses the whole process, hence bring in more revenue and profit. For the operators of the whole SAIL solution, the running of the platform and managing the related data can achieve more revenue and profit. For elderly people, the SAIL solution provides a multi-level, individualized and cost effective service scope.

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Intel IT: Danny Ding

SSIDC: Lanning Tian

Shanghai VSI: Yong Ding, Jiefan Hu

2 China Social Science Institute, China Aging Development Report, 2013
3 Beijing Evening Paper, Oct 31st 2014
4 China National Committee on Aging, 2010 Year China Urban and Rural Aging Population Survey Report

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