

NTT Docomo transforms complex legacy IT system into a cloud-native environment



Software and services

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Mobile telecommunications service provider NTT Docomo faced challenges maintaining its legacy back-end system after years of upgrades and modifications, such as significant data migration issues. To modernize the system with a shift to a cloud-native platform, NTT Docomo's Service Design Department worked closely with Red Hat Consulting to adopt new technology and data management approaches. With an agile, collaborative approach, NTT Docomo decluttered its source code, reimagined the existing system with a continuous integration and continuous delivery (CI/CD) pipeline, and developed a comparison tool to simplify the migration from legacy to cloud. Combining Red Hat OpenShift® with certified Red Hat middleware technology now helps the service provider's teams efficiently design, develop, and manage cloud-native applications.



Telecommunications

7903 employees
 (as of March 2023)

215 group companies

Benefits

- ▶ Enhanced user interface (UI) with simplified logic
- ▶ Established CI/CD pipeline, reducing development time by 87.5%
- ▶ Developed comparison tool to simplify move from legacy to cloud system

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Chief of Application Development,
 Service Design Department, NTT Docomo

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Innovation is the core of open source. Red Hat customers use open source technologies to change not only their own organizations, but also entire industries and markets. Red Hat Innovators in the Open proudly showcases how our customers use enterprise open source solutions to solve their toughest business challenges. Want to share your story? [Learn more.](#)



(From left) **Kaori Gunji**, Services, Services Leader (Ent & Comm), Consulting #5, Senior Consultant, Red Hat; **Takanori Nagahara** Chief of Application Development, Service Design Department, NTT Docomo; and **Tomohiro Kamata** Services, Services Leader (Ent & Comm), Consulting #5, Senior Architect, Red Hat

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Takanori Nagahara
Application Development,
Service Design Department,
NTT Docomo

Modernizing and simplifying a legacy system with a cloud-native foundation

After NTT Docomo, a prominent Japanese mobile telecommunications provider, began offering internet services for cell phones in 1999, its related back-end system evolved rapidly to meet the resulting demand. This system consolidates sub-systems for deploying digital content for 3G and 4G devices, content management, billing integration, and other critical functions..

As services were added or expanded to support the website for registering carriers’ custom mobile apps and distributing apps to devices, maintaining this back-end system quickly grew complex. Within just one service on the back-end system, branching processes to address different use cases generated approximately 800 screens, close to 8,000 pages of written specifications, and nearly 500,000 lines of source code.

“Running our legacy system required a lot of effort,” said Takanori Nagahara, Chief of Application Development, Service Design Department, NTT Docomo. “We generally replace hardware on a 5-year maintenance schedule, but during every migration we would encounter major problems. Identifying their source and performing extensive testing took a lot of time and effort—and sometimes, we still couldn’t fix the problem.”

To simplify future migrations, the Service Design Department decided to modernize the entire back-end system by transforming it into a cloud-native architecture.

“It’s a huge system, so refactoring it with a new platform and vendor was going to be a major challenge,” said Mr. Nagahara. “Breaking away from conventional system development using only technologies provided by SIs [system integrators] was a big decision. But we knew that the effort to set up a cloud-native operating environment would help us reduce developer workloads and cut maintenance costs.”

Taking a collaborative approach to support shift to container technology

Based on trend research into container technology for cloud-native systems—as well as the availability of certified middleware—NTT Docomo decided to use Red Hat OpenShift as the foundation of its new back-end system environment.

“There are many container platforms available, but Red Hat OpenShift stood out for its amazing stability, scalability, and flexibility. We also appreciated that it has been proven through a large number of deployments around the world,” said Mr. Nagahara.

As part of its modernization project, the Service Design Department also adopted Red Hat Application Foundations, a comprehensive set of components and technologies that help organizations modernize, build, deploy, and operate their applications across hybrid cloud environments. Combined with and certified for Red Hat OpenShift, Application Foundations optimizes application performance across their entire life cycles, whether on premise or in cloud environments.

Some of NTT Docomo’s engineers and third-party vendors were concerned about the impact of refactoring such a large, complex system. To speed and support this significant change, the telecommunications provider engaged Red Hat Consulting.

“As the company with the most cell phone subscribers in Japan, any problems would affect a lot of users and risk losing their trust,” said Mr. Nagahara. “We also have no experience with cloud-native technology. But Red Hat’s experts were able to understand our high-level vision very quickly. We were then able to work as a single team with Red Hat and the vendors to complete a proof of concept.”

During the proof of concept, this joint team successfully recreated some of the key operational processes of the back-end system within just 1 week—and continued collaborating to complete production deployment and migration. “After some initial hesitation, we were confident that proactively introducing outside best practices would make a major contribution to improving costs and future development.”

Reviewing legacy code and processes to design efficient application life cycles

Enhanced user interface (UI) with simplified logic

As a key step in its successful cloud migration, NTT Docomo reduced the number of screens in its existing legacy system by 75% through reviewing and simplifying functions. These changes helped NTT Docomo create a more intuitive experience for users of its services.

“To ensure efficient operations, we took the opportunity presented by the migration to find and remove all unused functions,” said Mr. Nagahara. “Removing the screens didn’t remove the program code itself, which is incredibly intricate at this point, but did help us determine what needed to move forward into our new container-based system.”

Established CI/CD pipeline, reducing development time and TCO

After completing the improvements to the back-end system’s logic, the Service Design Department then used Red Hat OpenShift Pipelines to establish a new continuous integration and continuous delivery (CI/CD) pipeline. This new approach automates application development—a necessary change for the telecommunications provider’s cloud-native transformation.

“In our company’s service guidelines, testing and production environments had to be kept completely separate, so this approach of continuous automation from coding to testing to deployment was completely new to us,” said Mr. Nagahara. “My team examined each step and ensured automation was implemented in line with requirements to successfully create a CI/CD pipeline incorporating some human review.”

Compared to the previous waterfall development approach, where each step of development happens in a linear sequence with formal hand-offs to the next stage, NTT Docomo’s new CI/CD pipeline and agile Scrum processes support more flexible, test-first application development.

“Testing used to happen only once. We’d get everything ready and then complete,” said Mr. Nagahara. “Now we can use test versions as assets, an important change as we lose institutional engineering expertise over time. Rather than solving problems using individual tests, we can build up standard pipelines and documentation by repeating the testing and feedback cycle during agile sprints.”

This new test-first approach, combined with the efficiency provided by a consistent, automated application pipeline, has helped NTT Docomo reduce the total cost of ownership (TCO) of its back-end system.

Developed comparison tool to simplify move from legacy to cloud system

As the final step for completing its modernization project, NTT Docomo’s Service Design Department worked with Red Hat’s consultants to develop a tool to automatically compare the legacy and new systems.

About NTT Docomo

NTT Docomo, Inc. is Japan's largest mobile telecommunication services provider, and has contributed to the popularization and spread of cellphones, while expanding the potential of cellphones as IT infrastructure by incorporating a diverse array of functionalities. Under the slogan of "Changing worlds with you," NTT Docomo is accelerating evolution. Affiliations and titles are as of time of interview (March 2023).

"To achieve the savings and efficiency improvements we were aiming for, the new system design was different from the legacy system. But data input and output, as well as other aspects of operations, needed to be the same," said Mr. Nagahara. "The documentation for the legacy system was incomplete, and there weren't many comments in the source code. To get a comprehensive understanding of the specifications, we had to review the source code."

Creating this tool meant overcoming challenges in extracting data from a tightly secured, actively running system, but the sheer volume of source code required an automated approach.

"Modifying the internal design using this tool was an extremely delicate process," said Tomohiro Kamata, Senior Architect, Red Hat Consulting. "The comparison tool showed what source code would not be needed in the new system, but leaving code out worried the developers. However, migrating unneeded code would not only be inefficient during the initial process, but also risk the type of future complexity and confusion that NTT Docomo was determined to prevent. So we worked very closely with their team to apply the findings of the tool."

Combined with the new CI/CD pipeline, code removal using the comparison tool during the refactoring process helped NTT Docomo shorten its application release cycle by 87.5%.

Expanding the benefits of open collaboration and innovative technology

By working together as a single, collaborative team, NTT Docomo successfully modernized its legacy back-end service system in a project that can now serve as a model for other teams within the telecommunications provider's organization.




"In our experience, theoretical discussion rarely helps bridge gaps in approaches to create the alignment needed to move forward without introducing new complexity," said Kaori Gunji, Senior Consultant, Red Hat Consulting. "By presenting a visualization of the proposed cloud-native solution and facilitating open, guided exchange of opinions, we created a shared understanding of the current and desired state with not only NTT Docomo but all involved vendors. That open, collaborative atmosphere really helped the project move forward and succeed, despite introducing completely new technologies and approaches like scrum."

NTT Docomo plans to continue working closely with Red Hat to fulfill its goal of connecting the present to a better future using the latest technologies. "Our company is still full of legacy systems that could benefit from this kind of structural change," said Mr. Nagahara. "For example, the i-mode mobile internet service for feature phones discontinued, and we will probably use that change to set a new milestone for the future."



About Red Hat

Red Hat is the world's leading provider of enterprise open source software solutions, using a community-powered approach to deliver reliable and high-performing Linux, hybrid cloud, container, and Kubernetes technologies. Red Hat helps customers develop cloud-native applications, integrate existing and new IT applications, and automate and manage complex environments. [A trusted adviser to the Fortune 500](#), Red Hat provides [award-winning](#) support, training, and consulting services that bring the benefits of open innovation to any industry. Red Hat is a connective hub in a global network of enterprises, partners, and communities, helping organizations grow, transform, and prepare for the digital future.

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