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IT-Driven Customer Service or Customer-Driven IT Service:

Does IT Matter?

*This case was written by **Jens Hørlük**, University of Aarhus, **Jan Damsgaard**, Copenhagen Business School and **Christian Søndergård Jensen**, University of Aalborg.* *It is intended to be used as the basis for class discussion rather than to illustrate either effective or ineffective handling of a management situation.*

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IT driven customer service or customer-driven IT service: Does IT matter?

At the end of 2004, the Nykredit Group was doing well. In accordance with the overall plan of diversifying Nykredit from a mortgage bank to a retail financial institution, Nykredit had just successfully acquired another mortgage bank. The company portfolio of Nykredit was now close to being complete. Mortgage banking, retail banking, an insurance company, a real estate brokerage chain, and a real estate investor company comprised the Nykredit Group, making it a modern financial supermarket.. The deregulation of the Danish banking industry in the 1990s caused a lot of turmoil within the entire industry and had forced Nykredit into a radical reorientation of the company. From this Nykredit emerged not only as a survivor, but also as a clear winner. The remarkable competence of the IT staff of the Nykredit Group in maintaining, integrating and developing its multi-faceted portfolio of IT systems across the various constituent companies into a modern multi-channelled and multi-tiered IT infrastructure had accentuated the success of Nykredit's strategy. In 2004, the financial industry competition was again concentrated on gaining competitive advantage through differentiation and cost reduction.

Everybody agreed that IT was the answer to achieving both cost reduction and differentiation, but how could Nykredit be sure they would always have the right IT? Some argued that the customer side should drive the IT development in order to ensure that Nykredit would have the most relevant IT systems. Others had the opinion that radical business innovation leading to a competitive advantage could only be achieved through in-depth knowledge of what new and emerging IT could do and of how this could be linked with existing IT systems.

Acknowledging the importance of both sides, Nykredit had combined IT service and customer service into one powerful business development department. The creation of a central department had been extremely successful during the radical changes that Nykredit had been forced into during the 1990s. But could the success of the past be extended into the future?

The public debate on the value of IT as a competitive weapon had further stimulated this discussion.

Jan Damsgaard, Jens Hørlück and Christian Søndergaard Jensen prepared this case for use in class discussions. It is not intended for illustration of either effective or ineffective handling of an administrative situation.

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1. The Nykredit Group

At the end of 2004, the Nykredit Group[1] was one of the largest private issuers of bonds in Europe and the largest player on the market for property financing in Denmark. The group also participated in international financial markets, thus ensuring and further developing a sound capital market for the benefit of the individual and Danish society in general. Nykredit's product range encompassed mortgage credit, banking and insurance products, and property sales. The customer group was wide-ranging: Its base of 600,000 customers spanned private households as well as commercial, agricultural, and private rental borrowers. Nykredit also served institutional and professional Danish and foreign investors. See exhibit 1 for a financial overview and further details.

The objective of the Nykredit Group was to become an internationally competitive Danish financial institution by virtue of qualified employees, up-to-date services, an extensive product range, and innovative distribution channels.

The Nykredit Group was organized with Nykredit Holding A/S as the parent company of the mortgage credit group Nykredit Realkredit A/S.

As of late 2004, Nykredit Realkredit A/S owned the following legal entities:

- Another mortgage bank operating on the Danish market, Totalkredit A/S.
- A recently established mortgage bank for the Polish market.
- A bank, Nykredit Bank A/S, operating as both retail, investment and corporate bank.
- An insurance company, Nykredit Forsikring A/S.
- Two real-estate brokerage chains, Nybolig and Estate.

Nykredit's organization of operations did not follow the legal entities, but were oriented towards customer segments. Some segments were only served centrally, others through one of the 49 local offices as well as through call centres and the Internet. Some of the products were sold in a joint venture with 105 small and local banks and their 1150 branches.

1.1 IT and IS Organization[2]

The Nykredit IT and IS organization was split across several suppliers due in large measure to historical and economical reasons.

Nykredit's mortgage systems were developed by the company itself. The Nykredit IS organization was responsible for all mortgage systems as well as coordination of development and integration of all other systems.

The day-to-day operations of Nykredit's IT infrastructure (ITI) were the responsibility of a separate company, JN Data A/S. This company was established by Nykredit and a major Danish bank, Jyske Bank, to handle the IT operation of both companies.

Nykredit Bank used a service bureau owned by a cooperation of small and medium-sized banks. Totalkredit had their own applications, developed and managed by the same service bureau, and the long term plan was to convert all its loans to Nykredit's systems and operations to JN Data.

Nykredit Forsikring ran its legacy system at a service bureau owned by mid-sized insurance companies. Nykredit owned 25 percent of this service bureau and a similar share of the systems.

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[1] http://www.nykredit.dk/ - When we write "Nykredit", we mean "The Nykredit Group" as a corporate unity.
[2] Se section 4.3 for further details.

2. The Danish Mortgage Market

Practically all houses and farms and many industrial buildings in Denmark were financed via mortgage bonds. Of the newly issued loans, about two thirds were spent on financing individual family homes. Another ten percent was used for rental homes and fifteen percent for farms.

The mortgage bank sold fixed-rate mortgage bonds on the stock exchange, and the nominal value of the loan and the interest rate of the loan were set by the price of the bond on the day of issue. Most of the loans were fixed rate throughout the lifetime of the loan (typically 20 – 30 years). The remaining loans had some form of variability of the interest rate. For the debtor, fixed interests mean certainty in the sense that the cost of owning the house was known and independent of a future change in interest rates. On the other hand, it also represented a gamble, since the cost was determined by more or less random fluctuations in interest rates at the time of issue.

For example: a family buying a house would typically finance up to approximately 80 per cent of the price through a mortgage bank, using the house as security. The remaining balance was typically down-payment and a personal bank loan.

Danish mortgage banking had relied on a number of principles for over 150 years:

- Mortgage loans were mostly long term loans and were secured on the property. The valuation of the property, not of the person, was therefore in focus.
- The lender could only call in a loan, if the borrower defaulted on the loan.
- All borrowers issued mutual guaranties for each other, backed by the property, and bond investors had full knowledge of the security behind the bonds.
- The mortgage banks sold bonds on the market corresponding to the value of new loans. The bank itself had no funds involved.
- Loans were granted within the framework of the Danish Mortgage Credit Act.
- The interest rate was set by the market and was transparent.

2.2 The Bond Market

The Danish bond market was among the largest in the world, especially for long term bonds, with a nominal value in circulation amounting to about € 325 billion at the end of 2003, out of which mortgage bonds accounted for € 215 billion. The total market was characterized by a large number of bonds – 2300 in total - but the liquidity was concentrated in a very few, typically open series with standard loans granted by the mortgage banks. Since the internationalization of the financial markets in the 80's, the Danish mortgage bonds had been sold to foreign investors, and the Danish market for bonds was therefore dependent on the international financial markets. Compared to other Bond markets, the Danish Bond Market had a very large proportion of long-life bonds.

Danish mortgage bonds were highly secure for investors, because they were backed first by the capital base of the mortgage bank, which, according to the law, should amount to not less than 8 per cent of the risk-weighted assets etc of the mortgage. Secondly they were backed by the mutual guaranties. In the 200-year history of Danish mortgage banking, no bondholder has suffered a loss due to mortgage banks inability to pay.

Investors in this market were typically pension funds, insurance companies and others seeking highly secure long-term investments, which result in low interest rates.

2.3 Background

The historical background for this situation dates back to the middle of the 19th century, when groups of borrowers issued mutual guaranties for loans. During the period up to the World War I, this developed into an institutionalized market, with over 20 mortgage banks issuing series of mortgage bonds.

Since the early 1980's, the market had changed considerably due to a number of factors, of which the most important were:

- Deregulation.
- Changes in mortgage bank ownership.
- Changes in the role of the mortgage bank from wholesalers of anonymous services to retailers of individual customized packages.
- Higher volatility in the customer's affiliation to a specific mortgage bank.
- Long term mortgage bonds became known internationally.

2.4 Consolidation in a Highly Regulated Market (up to the mid 80's)

During the 1960's, 1970's and 1980's there was market consolidation, resulting in two large mortgage banks (Nykredit and Realkredit Danmark), which were approximately equal in size, and a smaller bank having a market share of a little over 15 percent of the private households. On top of that there were a few specialized institutions. Traditionally, the Danish Government had regulated the market very tightly, and as a result, all mortgage banks offered almost similar products and competition was practically non-existent. Since the mortgage banks offered the same types of loans with the same conditions and since interest rates were dependent upon the financial market, the typical borrower did not care which mortgage bank was used. Mortgage banks were only allowed to issue loans in sales situations, and refinance was not allowed, so loans stayed when a house changed owner. The new owner only added loans on top of the old and these loans traditionally went to the mortgage bank that had already financed part of the house, so once the "first" borrower had chosen a mortgage bank, his decision had long-term effects.

As a result, the middlemen in the process took the actual decision, and it was usual to write the name of the mortgage bank in the sales agreement for a house. The real estate agents were therefore the actual decision-makers in most cases. The real estate agent had a legal obligation to be neutral and the commission for providing the loan was regulated by law, so there were no specific financial incentives for recommending one bank instead of the other.

At that time real estate agents were either personal businesses or small independent companies. During the 1980's, there was a consolidation of estate agents, most of whom were associated with one of three chains of agents: one owned by Nykredit, one by Realkredit Danmark and the last was independent, but cooperated closely with the third mortgage bank.

All in all, the traditional culture in the mortgage banks was not market-oriented. They were all wholesalers on a commodity market.

2.5 Deregulation (from the mid 80's)

Like all other EU countries, Denmark deregulated the financial market during the 1980's to create a common capital market with more competition. Deregulation continued in the 1990's changing the market situation completely, mainly on three aspects:

1) Refinance of existing loans was allowed and anyone could, at any time, take up loans in a mortgage bank. This had profound consequences, because every time a loan was refinanced, there was a risk of the debtor changing mortgage bank. Examples of such situations were:
    - Refinance was almost always arranged when a house was traded.
    - Most of the Danish Bonds were callable, i.e. the debtor could repay the loan either by paying the outstanding debt or by paying the nominal value of the backing bonds. At time of issue, the bonds behind the loan were always issued slightly under par. If the interest rate fell, the price of the bond increased to over par and the debtor could use his call option by paying the nominal value of the bonds and refinance it with newly issued bonds. If the interest rate rose again, the price of the backing bonds would fall far below par and the debtor could exercise his call option once more and wait for falling interest rates, thus repeating the cycle.
2) Introduction of new types of loans were allowed. Examples:
    - A new type of loan took advantage of the fact that during the 1990's the long term interest rates were higher than short term interest rates. Financing long-term loans with short term rollover bonds were therefore cheaper for a number of years.
    - In 2004, a variation of this type of loan was introduced, with a guarantee that the interest rate would not exceed a predefined limit.
    - In 2003, a new type of loan, where the borrower only paid interest (but not repayment) for 10 years, was introduced.
3) New mortgage banks were allowed on the market. See below.

All in all this meant that borrowing became more complex and required more advice. And it also meant that house owners could borrow more and that they were therefore more financially vulnerable. As a consequence, the borrower's personal retail banks would play a crucial role for most of the borrowers.

2.6 Restructuring the Industry: From Wholesalers to Retailers

From 1989, as a result of deregulation, new mortgage banks were allowed and the three major commercial banks and a group of smaller banks set up their own mortgage banks in the form of subsidiaries. The two largest banks, Danske Bank and Nordea, had each established their own mortgage banks, and most of the other banks had established a third new mortgage bank: Totalkredit.

In the late 90's Danske Bank had merged with BG bank and with Realkredit Danmark. BG was third largest retail bank in Denmark and stayed on the market as its own brand. Realkredit Danmark was merged with Danske Bank's own mortgage bank.

One such change was a clearer focus on cost of operations, streamlining processes etc.

Nykredit had negotiated mergers in the 90's with other banks, but kept their status as an independent company and had instead acquired a couple of small banks, which merged and changed their names to "Nykredit Bank".

For Nykredit these last 10-15 years had seen a dramatic change in the competitive situation. From regulated oligopoly to strong competition, especially because one type of middlemen, the retail banks, now dominated the sales channels. Not only were they actively pushing their own subsidiaries, they

were also providing packages of mortgage financed loans, personal loans and insurance. Especially for the financially vulnerable younger generations, such a package was often attractive, if not necessary to buy a private home. Focus changed from providing a more general service to servicing the individual customer's needs. Therefore the actual decision of which mortgage bank to choose had changed from one group of middlemen to another, i.e. from real estate agents to banks.

At the turn of the century, Nykredit together with BRF were left with no sufficient physical distribution channel for their own traditional mortgage products. Nykredit had 49 regional offices and over 200 real estate agents, but this number alone could in no way substitute for the other mortgage banks' customer connections via the traditional banks, mainly because most borrowers in Nykredit were not bank customers in Nykredit bank and therefore did not have regular contact with Nykredit.

2.7 The Internet and Call Centers for Customer Contact

As a substitute for traditional offices, Nykredit had implemented a multi-channel contact to facilitate a customer orientation. Telephone banking using call center with long opening hours was well established. The call centers were not only handling simple calls from a central site but also more complex tasks through a network of trained personnel. The call centers were supported by a variety of contemporary IT systems to provide the necessary information for the operators.

The Internet opened up new possibilities for reaching more potential clients and enhancing the relationship with existing customers. This was indeed a positive development that favored companies with extensive and modern IT capabilities, a professional IT department to maintain and develop the IT infrastructure, a good and respected brand name and a significant share of the market. In all these respects, Nykredit was in an advantageous situation.

As an example, Nykredit daily handled 2000 requests for new or remortgaged loans via the Internet.

Both the call centers and the internet systems were supported by the same centralized back-office systems that were used for the more traditional customer contact.

But the Internet posed challenges as well. This was already clear to the banking sector. The Internet had opened up the retail banking market partly because regional banks used the Internet to gain a national presence to communicate with their customers all over the country and partly through new banks established for the Internet only with a low cost strategy.

2.8 The Acquisition of Totalkredit

All this led to Nykredit's acquisition of Totalkredit in the summer of 2003. As part of the deal, the owners, 105 small banks, would sell both Nykredit and Totalkredit loans through their 1150 branches.

Table 1 - Ownership and retail bank market channel in the late 2003

Mortgage Bank	Connected to retail bank	Retail bank's market share [a]
Realkredit Danmark [b]	BG bank	50.7%
	Danske Bank	
Nordea kredit	Nordea [e]	23.5%
Nykredit and Totalkredit [c]	Nykredit Bank [d]	2.8%
	105 small banks	Approx. 17%
BRFkredit	A few small banks	< 1%
4 Specialized mortgage banks	Special market conditions and customer relationship	

Table 2 – Mortgage Bank market share

Mortgage Bank	Share of new loans, gross - Year 2000	Share of new loans, gross - Year 2003	Share of outstanding bonds - 31 Dec. 2003
Realkredit Danmark [b]	35%	32.3%	34.9%
Nordea kredit [e]	10%	13.7%	9.8%
Nykredit	29%	25.6%	29.5%
Totalkredit [c]	11%	14.7%	11.4%
BRFkredit	10%	8.6%	9.7%
3 specialized mortgage banks	4%	5.3%	4.8%

Notes for tables 1 and 2:

a. The market share is here measured as the percentage of the total balance of all Danish retail banks. It gives an indication of the power of the backing bank.
b. Danske Kredit (formerly owned by Danske Bank), BG Kredit (formerly owned by BG Bank) and Realkredit Danmark formally merged on Jan. 1, 2001.
c. Totalkredit was until mid 2003 owned by 105 small and medium-sized banks and had been growing very fast during the last years. Mortgages were sold through the owning banks. Nykredit acquired Totalkredit in the summer of 2003.
d. Nykredit Bank did not sell Totalkredit loans.
e. Nordea was the second largest bank and a member of the Nordea Group (Nordea.com), which consisted of large banks and insurance companies in all of the Nordic Countries. Nordea Kredit was fully owned by Nordea Bank.

A potential threat that had not yet materialized could be foreign banks establishing Internet banking only. Already having created the IT infrastructure, these banks would just have to expand their home market systems to Denmark. A few foreign banks had bought into other Danish banks instead.

3 A Unified Vision

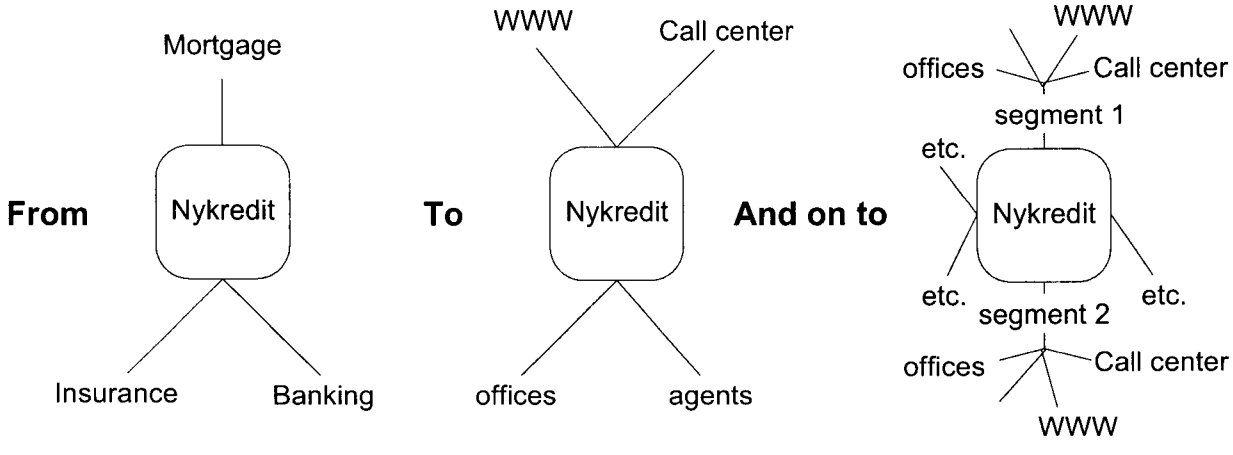
The key for Nykredit for both the business side and IT infrastructure side was that regardless of means of communication (Internet, face to face, call center) and nature of financial need the customer should be met by a unified approach. The customer should not worry about crossing technical or organizational barriers, but solely focus on his own situation. This vision pervaded Nykredit in 2004.

3.1 Merging of Customer Relationships, Organizations and Culture

In the beginning of the new century, Nykredit treated all customers as customers of the corporation. This had required a redefinition of Nykredit's means of interacting with customers in order to approach the customer as one company while retaining specific knowledge and delivering competent service across all types of products. Nykredit had changed its view from customer relations using product/market-defined channels to functionally defined multi-channel relations, in which any customer could use any channel to communicate with Nykredit. This is demonstrated in the left part of figure 1. Being a financial supermarket, which sold many different products, and the acquisition of Totalkredit both contributed to making it a challenge for the ITI to support the concept of corporate customers. Support for the notions of segment and channel added to this challenge, in addition to creating their own challenges to the ITI.

A *segment* was a group of customers that were expected to be similar with respect to the products that they were likely to be interested in. Examples of segments included "farmers" and "seniors," where seniors were customers that were expected to be interested in products of particular interest for senior citizens. This segment could actually include younger customers as well. The assignment of customers to segments was key in offering the customers a personalized service – and for this reason, the notion of a segment is important. The ITI offered support for segments, including the flexible categorization of customers according to segment and the personalization of services based on segments.

Figure 1



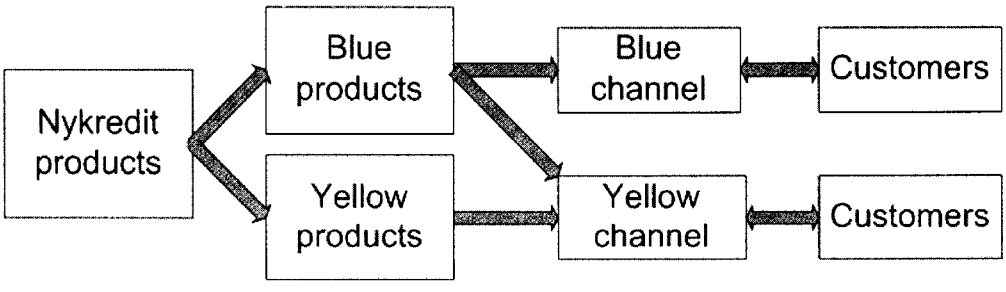
A *channel* denoted broadly speaking a means of purchasing a product offered by the Nykredit group. These products included the products offered by Totalkredit, termed the yellow products, and the products offered by the other parts of the Nykredit group, termed the blue products. At a high level, the Nykredit group and the ITI distinguish among three channels, as shown in figure 2. The so-called

yellow channel consisted of the 105 banks (with some 1100 branches) that previously owned Totalkredit; they sold both yellow and blue products. The *blue channel*, which sold only blue products, denoted the remaining part of the Nykredit group, which existed prior to the purchase of Totalkredit. By this definition, each virtual channel employs, or is realized through, a variety of channel technologies such as voice response, desktop Internet, PDA-based Internet, mobile-phone wireless Internet, call centre, and personal contact at the regional offices. Both channels were supported by centralized IS backed procedures, but for the customer it appeared as if each channel had its own separate administration and as if information was sent by their personal contact.

Customers were not "owned" by channels or by individual banks in the yellow channel. However, yellow banks were obligated to ensure that their banking customers were offered the mortgage products, yellow or blue, that best met the needs of their customers. When a yellow bank sold a product to a customer, the bank received a fee. The fee for the yellow products was higher because the bank had to guarantee for the loans.

The ITI included a web-based *partner portal* that provided support to the yellow channel. Through this portal, the yellow banks had access to customer information. An individual bank typically had access to information about a customer's blue products. A customer in one yellow bank could also be a customer in another (yellow) bank. However, as banks could be competitors, the portal did not reveal information to one bank about a customer's relation to another bank. Next, different yellow banks offered their customers different home banking solutions. The partner portal offered information and functionality in relation to the customers' mortgage products that could be integrated seamlessly with these home banking solutions. A longer-term goal was to extend the partner portal so that it could be used beyond the yellow banks, by all parts of the Nykredit group.

Figure 2



At a more technical level, and at a lower level of abstraction, channels included Nykredit's Internet customer portal, Nykredit's call center, Nykredit's customer centers, and yellow branches and associated call centers.

3.2 A Unified IT Infrastructure Vision

The ITI maintained integration and transparency among these channels as business needs evolved. For example, this implied that the particular channel which a customer happened to use when contacting the Nykredit group did not affect the specifics of the products available to the customer and the service and guidance the customer received. It also implied that all customer information received through one channel was available when the customer contacted the Nykredit group again, independently of which channel was used for the contact. This presented the ITI with tough requirements (see exhibit 2 for details).

The overall goal in maintaining and evolving the IT Infrastructure (ITI) was to always support all existing needs of the business. As it can take substantial time to adapt the ITI to new business needs, meeting this goal required Nykredit to anticipate business needs that would come into existence up to some five years into the future and to start preparing the ITI for the anticipated business needs.

Consider an example. Prior to the deregulation of the Danish mortgage market, there was no competition for customers, and IT systems were very much oriented towards loans, as opposed to customers. Well before the business started to demand customer orientation, work was underway to adapt the ITI to this demand. This anticipation was essential, as the necessary modifications of the ITI were substantial and time consuming. As another example, the ITI was being re-shaped to support the notion of a *corporate customer*, as opposed to, e.g., a banking customer or an insurance customer, well before this notion became a business need.

It was an important challenge to anticipate future business needs, to determine the consequent ITI requirements, and to initiate cost-effective processes which resulted in an enhanced ITI that met the business requirements just in time. Success was contingent on intimate knowledge of the business, the existing ITI, and the general technological development. By successfully meeting this fundamental challenge, the ITI enabled Nykredit to not only follow the competitors' new strategic moves in the market, but to continuously be able to develop new business opportunities and to exploit new developments in the markets and stay ahead in the market.

Ensuring that the ITI always met all business needs represented a never-ending process. In general technical terms, it was of central importance that the ITI was able to absorb and support new systems and technologies, while simultaneously accommodating the bulk of aging legacy systems on which the business depended. History showed that although the specific systems and technologies to be used in the future were unknown, there was little doubt that the business would pose requirements that would entail the integration of new systems and technologies into the ITI. A more specific challenge was to keep the existing legacy systems up-to-date, in some cases by modernizing them and in others replacing them with new systems using technologies that were state-of-the-art. Legacy systems were to be integrated with new systems, e.g., by breaking them down into pieces that fitted into the architecture.

4. IT Infrastructure

To be able to meet these as well as more specific challenges, an architecture for the ITI that was component-based, service-oriented, and layered had been chosen. The ITI employed a slew of modern technologies, including enterprise application integration; multi-channel technology support; customer relationship management; content management and deployment; advanced workflow management; personalization; and data mining. The ITI aimed to use mainstream technology rather than specialized technology; and generic solutions that could subsequently be specialized were sought.

4.1 Availability of Customer Data

Conceptually in an integrated IT infrastructure, i.e., in high-level logical terms, an integrated repository recorded all customer-related information disclosed to the Nykredit group. Data were created at each contact with a customer, and all relevant data on a customer that was available in the repository was made available at each subsequent contact with the customer. The repository built on a uniform customer model. All systems in the ITI "subscribed" to this model.

The customer repository represented a substantial achievement. Prior to its existence, real estate customer data was not simply stored in one single and authoritative database. Rather customer data

was stored in more than a dozen systems and databases. The existing systems represented thousands of invested man-years, and there was no way the functionality of these systems could be rebuilt within a reasonable timeframe, not to mention that the cost of rebuilding them could not be justified.

The repository collected information across all channels. For example, customers interacting with Nykredit via the Internet would leave information in the shape of data entered into forms and in the shape of click streams, which were sequences of simple records generated at each "click" entered by the customer. All such data was entered into the repository, from where it was subsequently accessible.

Based on analyses of the customers' interactions with the company as captured by the customer data, the interests of each customer could be determined and included as part of the customer's profile. It was also possible to apply data mining techniques to the repository and thus obtain new and useful customer information. This was essential in enabling the company to offer the "right" products and services to the individual customers, and it was also a prerequisite for ensuring that customers were treated seamlessly across all channels.

4.2 ITI Requirements due to Corporate Customers, Segments, and Channels

Specifically, the ITI must enable the Nykredit group to provide its customers, in all areas of the business, with a *single, seamless view of the Nykredit group* and the products and services provided. This view had to apply across all channels through which a customer may interact with the company. Recall the example from Section 3.2, where a customer contacted the Nykredit call center several times to solve a problem. This customer should not be required to first explain about the original phone call before being able to ask the question. Rather, the ITI should recall the previous interaction with the customer and make a record of this available to the company representative in the call center who interacts with the customer during the second call. This seamless-ness should also apply for data entered via the Internet or one of the regional customer centers.

Next, making all products and services offered by the company available through a single channel, such as the Internet portal, was a challenge. However, the ITI must ensure that all products and services, be it bank loans or insurance, were available through all channels.

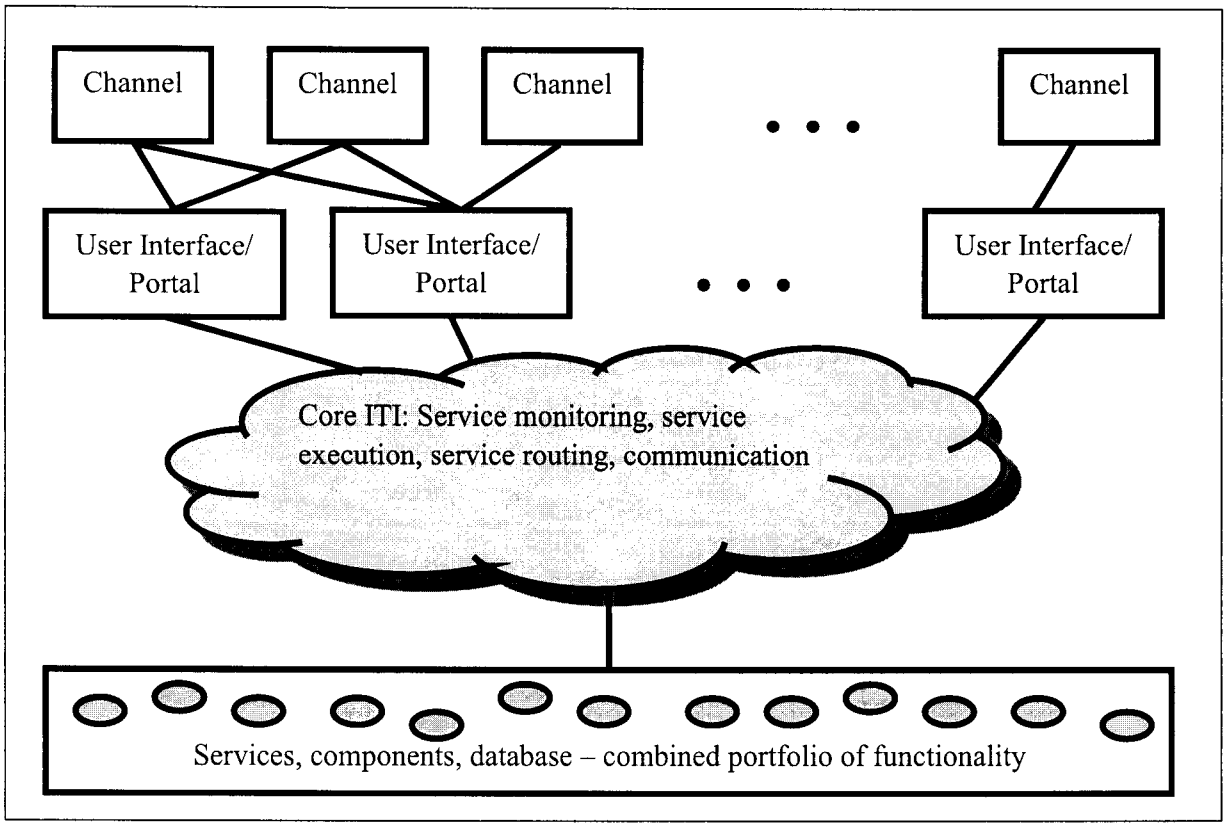
To support this unified view of products and services across all channels, the ITI must offer a unified view of the customers across the back-office systems that support mortgage-loan provision, banking, and insurance; and this view has to extend to the front-office systems that supported such functions as sales, marketing, and general customer service. The ITI must support a wide range of services across all channels. For example, the ITI must enable the Internet channel to support the full range of customer services and products offered by the Nykredit group. To achieve this, the ITI must provide access to a range of systems, including new systems and legacy systems.

Figure 3 on the following page illustrates the high-level architecture of the ITI together with the channels discussed above. The combined portfolio of functionality offered by all systems is illustrated at the bottom of the figure. This functionality was made available in the form of services, components, and databases. At the top of the figure, the channels make use of user interfaces, or portals. Here, functionality deriving from possibly multiple services, components, and databases was combined. The Core ITI in the middle of the figure is the nerve center that makes this possible. This so-called middleware executes, routes, and monitors services.

Finally, a long term vision that the ITI may need to support is customer self-service. Specifically, today's customers contact a staff member when they wish to purchase a product, and the staff member then uses the ITI when servicing the customer and selling the appropriate product. The vision was to

remove the staff member, the human middleware, from the equation, instead providing the customer with the ability to purchase products directly, via an advanced ITI. Put simply, the customers themselves, not the customer representatives, should do the work. For example, customers should themselves be able to create accounts. One may think of this vision as the extension of the partner portal to also be used by the customers.

Figure 3 – Overall IT Infrastructure



4.3 Legacy Aspects of the ITI

Nykredit's business could be divided into three areas, with mortgage loan provisioning being dominant and the oldest. The Danish mortgage-loan market was unique, for which reason special-purpose IT systems had been developed to support the business. These systems had traditionally focussed on real-estate properties rather than on customers and customer service. They were also developed on the previously valid assumption that Nykredit was solely a mortgage-loan provider and thus offered no integration with banking and insurance.

In comparison to the length of the history of electronic business data processing, the Nykredit group had had a long history in the mortgage-loan business. No standard systems were available for the Danish mortgage market when Nykredit[3] first established IT support for its operations, and the current mortgage systems resulted from decades of development and maintenance. This had several implications for the legacy ITI and its constituent systems. To get an idea of the complexity of the legacy aspects of the ITI, it is instructive to learn that Nykredit had more than two dozen systems that concern mortgage-loan provision alone. The entire ITI consisted of more than 350 systems.

Nykredit Bank ran its banking system at a service bureau owned by a cooperation of small and medium-sized banks[4]. As such, the banking system consisted of some 50 separate systems and was

[3] To be more precise: IT was initiated decades ago by the mortgage banks that have merged into what today is Nykredit.
[4] There were only six installations with bank systems on the Danish Market. The three biggest banks had their own, and

updated and in line with the requirements for banking in Denmark. However, these legacy systems also dated many years back. Nykredit had chosen to use these systems because the size of the bank was far too small to justify development of its own banking systems and because there were no shrink-wrap, standard banking systems available for the Danish market. Buying into existing systems was the only economical way to get the job done. These banking systems were built for banks with networks of branches, which did not match Nykredit's situation. Nykredit therefore had to develop proprietary functionality to suit its special needs.

When Totalkredit was acquired by the Nykredit group, Totalkredit was serviced by the same bureau that serviced Nykredit bank.

Nykredit Forsikring ran its legacy system at a service bureau owned by mid-sized insurance companies. Just like with the banking systems, Nykredit was not in a position to easily make changes to its insurance systems. Basic changes required agreement with the other owners, whereas added functionality could be made for Nykredit alone.

The constituent parts of the Nykredit group thus used tree different sets of legacy systems with some parts being run by service bureaus.

4.4 Legacy and ITI Challenges Ahead

Due to its many years in business and to its evolution, the Nykredit group used a range of fairly old IT systems, some of which were conceived back in the eighties, seventies, and even the sixties. These legacy systems were all successful in the sense that they performed important or even mission-critical and invaluable functions in the company. However, they also employed technologies now considered as outdated and old-fashioned, and that did not always mix well with the modern architecture deemed necessary for supporting the business.

Another challenge posed by the presence of legacy systems was that many prospective employees, particularly young professionals having recently finished their education, had little interest in and were unskilled at working with legacy technologies and systems. Universities no longer teach Cobol, which made the hiring of new staff to work with these systems more of a challenge. This highlighted the need to treat knowledge of legacy technology and systems as a core competency in the company. Another issue in dealing with legacy systems was that in some cases, the employees that built and subsequently maintained those systems were no longer with the company. Because adequate documentation was not always available, this could represent a substantial problem.

There was another significant consequence of the Nykredit group's long history and the shifting legal requirements for mortgage loans over many years: Because Nykredit could not call in a loan, the existing legacy (and new) systems had to deal with a host of different kinds of loans, some of which had not been offered for many years, or existed in quite small quantities, or were obscure and of little interest.

Nykredit expected that it would take 2 to 3 years to integrate the Totalkredit ITI into the Nykredit ITI. Upon completion of this, the operation of the Totalkredit ITI would then be moved to JN Data.

As a result of Nykredit's particular evolution and its age, the existing infrastructure consisted of systems partly relaying on technologies that were previously state-of-the-art, but that were now considered outdated. Furthermore, the existing systems were designed for and optimized to support a

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the rest used one of three service bureaus, mainly owned by their customers. Nykredit was not among the owners. Like any other nation, Denmark had its own set of laws and industry tradition, which made it impossible to buy banking systems from other countries. As a consequence, there was no market for banking systems, only for components.

business which afterwards developed into something quite different. Finally complexity increased because of changes in the laws under which the business had been operating over the years, and because of the continued introduction of new products and services.

As a consequence of the legacy aspects, the ITI had to integrate several types of systems:

- **N-Channel Systems**. These were modern systems that were service oriented and enabled the delivery of services to clients on multiple platforms.
- **Monolithic Systems**. These systems did not support layering of functionality into the desired data access logic, business logic, and presentation logic layers. The functionality may either be placed on an application server or on clients, resulting in centralized and decentralised monolithic systems.
- **Two-Layer Client/Server Systems**. These systems deviated from the previous class of systems by separating data access logic from all other functionality. Data access logic resided on an application server. Business logic may reside on an application server or on clients, or may be split among these. Presentation logic may also reside on the server side or on clients. When business logic resided in part or in full on clients, these were termed fat clients.
- **Three-Layer Client/Server Systems**. Common to these systems, clients were relatively thin and platform independent; and data access and business logic resided on the server side and were separated into different layers. Presentation logic also resided in its own layer.
- **N-Layer Systems**. Here, program logic was divided into data access, business, and presentation logic. Clients were connected to the server side with the program logic via the web, and Internet browser or Java virtual machine-based presentations were generated with the aid of portal and web servers. Clients were thus platform independent.
- **Business Intelligence Systems**. These systems regularly received data from databases via database servers. Separate, application-server resident subsystems performed ETL (Extract, Transform, Load) on this data. The transformed data was loaded into an enterprise-wide data warehouse, from which so-called data marts were created. A number of client-side subsystems operated on the warehouse and marts.
- **Groupware Systems**. The general tools available to Nykredit employees via the Intranet belonged to this category. These tools included e-mail, calendars, MS Office type tools, etc.
- **Batch Systems**. These systems were characterized by relatively infrequent, but resource intensive, batch runs. For example, batch runs occurred in connection with quarterly mortgage payments. The systems involved were typically monolithic or three-layer systems.

Backend host systems employed new technologies such as C/C++/Java, XP/RUP, and UML, in addition to legacy technologies such as Cobol, CICS, Cool:Gen, CBD96, and MQS. Mid-tier application servers employed Java EJB, Java JMS, Java proxies, XP/RUP, and UML; and in addition, mid-tier web servers employed Java Servlets, Java JSP, WML/HTML, and XML/XSL. These were but some of the technologies that had to be mastered to create an ITI supporting the business. The following list of technologies only provides an impression of their range and diversity. On top of this, new technologies emerged more rapidly than ever.

Figure 4 lists technologies found in the ITI. We proceed to consider in more detail the integration of systems in the ITI.

Figure 4 – Technologies and Suppliers

Technology	Supplier
Gen, previously Advantage:Gen and COOL:Gen CASE	Computer Associates
BEA WebLogic Enterprise Platform	BEA Systems
Catalogue Manager	IBM
COBOL	IBM
CTI (Call Center Technology) CVS (Concurrent Versions System)	Genesys Standard. Under GNU Public License
Data Stage	IBM
DB2 (DataBase 2)	IBM
Delphi	Borland
J2EE (Java 2 Enterprise Edition)	Standard/Sun Microsystems, Inc.
JAZZ	
Lotus Domino og Notes	IBM
Magic Draw	No Magic
Microsoft Office (Word, Excel, Powerpoint, Visio)	Microsoft
MQ ORACLE	IBM Oracle
RoboHELP	Macromedia (previous eHelp)
SAS	SAS Institute
Siebel Sales + Siebel Marketing Silk Performer	Siebel Segue Software
SQL (Structured Query Language)	ISO standard
Strobe	Compuware
Tivoli	IBM
TOAD (Tool for Oracle Application Developers)	Oracle
T-RAP	Own system
Visual Studio .Net	Microsoft
XML Spy	Altova
Xpediter	Compuware

4.5 Integration of Diverse Systems

Nykredit, with only a few hundred IT specialists, could not (and should not!) develop all the necessary systems by themselves. Therefore, the strategy involved the purchase of standard packages and ASP solutions. In areas of strategic importance to the company, in-house development, or possibly out-sourced development, occurred when there were no adequate systems available on the market. In areas of no strategic importance, the company purchased best-of-breed systems (the best performing standard systems within a narrow functional area) and best-of-suite systems (a package of well performing and integrated systems). These systems follow the architectures described in the previous section. As a result, the ITI must at any time keep the systems developed in-house up to date and enable the coexistence of acquired systems. Creating and maintaining an infrastructure that enabled the integration of this mix of systems represented a major effort.

In the ITI, integration among systems would be relatively easy if all systems were built according to the principles of layered, service-oriented, component-based architectures, but this was generally not the case. Thus, integration could occur in more than half a dozen ways.

- **Integration of Systems via a Joint Database**. Systems were integrated by enabling them to perform transactions that modify the same database. In the current ITI, more than 500 programs access the same customer table.
- **Integration via Batch Exchange of Files among Systems**. Here, data from one system's database was exported into files and possibly reformatted. The files were then read into the other system. A separate batch program was used for this integration, which occurred at the business logic levels of the systems. This approach enabled the creation of consistency among systems that did not offer appropriate interfaces for integration.
- **Integration by Switching Between Tools**. With this approach, integration occurred at the presentation logic level. Integration was achieved by enabling the user to switch between two tools available on the user's screen. For example, the user may have activated a customer via one tool. This customer then became available in another tool. This approach was effective in supporting business processes that involved several systems.
- **Integration by Screen Scraping**. Here, the integration occurred even higher in the layering, namely above the presentation logic layer, directly between presentations. Data from one system's presentation was screen scraped, and a program was then activated pasting the data into the presentation of another system. This type of integration introduced dependencies between the screen layouts of systems, and it was seen as a last resort, to be used when the systems involved did not offer the interfaces necessary for more semantic integration.
- **Integration through the Use of Deep Web Links**. With this approach, it was possible to integrate systems that used an Internet browser as client. The approach was typically used when integration using components or services at the business logic level was not possible. For example, this approach was used for a third-party facility enabling web users to see the location of a real-estate property on a map, to get directions to the property, etc.
- **Integration via Synchronous Exchange through Interfaces**. Here, one system's business logic layer requested data from another system via that system's business logic layer. The integration was synchronous because the former system awaited a reply from the latter until it proceeded. The former system was thus dependent on the latter system being available, for which reason high availability of that system was of essence. This approach was being used widely for integration between two-, three-, and N-layer systems.

- **Integration via Asynchronous Exchange through Interfaces**. With this approach, the business logic layers of two systems were connected via messaging: Each system had a queue of incoming messages and a queue of outgoing messages. A system then read messages from the other system via its incoming queue and sent messages to the other system via its outgoing queue. This arrangement offered a looser integration than the one using synchronous integration, and the operation of one system was not dependent on the other system being available.
- **Integration via Publish-Subscribe Based Exchange**. This approach generalized the previous approach. Here, a message broker was introduced as a hub in-between the systems to be integrated. A system could publish messages, and it could subscribe to messages. The broker kept track of subscriptions, and when it retrieved a message from a system, it sent the message to those systems that had a subscription that covered the message. Again, the communication occurred via queues.

5. The Core Challenges ahead

How could Nykredit be sure, they would always have the right IT? There seemed to be two sets of arguments:

The first would argue that the customer side should drive the IT development in order to ensure that Nykredit would have the most relevant IT systems. New demands should be formulated as requirements for the IT staff to respond to. Therefore the emphasis should be on customer-driven IT service! Critics of this stance argued that this easily led to a neglect of the complexity of modern IT based on superficial knowledge of technology.

The second would argue that radical business innovation leading to a competitive advantage could only be achieved through in-depth knowledge of what new and emerging IT can do and of how this can be linked with existing IT systems. It takes years to develop new IT systems, so from when the customer side identifies a demand, it then takes years before the corresponding IT systems can be in place. As a consequence, IT cannot lead to any substantial competitive advantage. Therefore the emphasis should be on IT-driven customer service! Critics of this position could point to numerous failures, where competent technologists tried to forecast market demands.

Nykredit had, with great success, combined IT service and customer service into one powerful business development department. However, the employees of the department had no direct customer contact; therefore it was difficult for them to keep up with new trends in the market and how customers received the various financial services. They also did not have direct contact with the IT side; therefore it was difficult to stay up to date on the implementation of IT systems. So over the years, it could become a challenge to avoid the department becoming more and more detached and alienated from both the IT and the customers.

Maybe the time was right to dispose of the middleman and to let the customer side and the IT side communicate directly with one another? But who should be in the driver's seat?

Regardless of how Nykredit chose to organize itself to make sure it would always have the right IT there was always the danger that business and IT would come out of synchronization. Therefore it was not a battle between IT and business, but a true dilemma. Maybe hiring hybrid candidates with a dual degree in business and IT would ensure that a critical mass of knowledge would be present in both worlds? In that way business would be well informed about IT innovation and IT would be abreast

with business innovation. Could it be that the middleman position of the original department was the best solution?

For all modern businesses the provisioning of a single, uniform model of a customer across the entire ITI is a key requirement. Implementing such a model across a large business such as the Nykredit group was a significant challenge in itself. Implementing such a model based on inflexible, poorly documented legacy systems built over decades by use of state-of-the-art technologies at the time of construction was an even harder challenge. Making the systems customer-oriented was part of this challenge. The solution developed should not simply consist of a common database for all systems, but had to be based on architecture with middleware enabling the linking of all the necessary components.

Exhibit 1 - Excerpts from Annual Report 2003

(Further material can be found at www.nykredit.dk)

THE NYKREDIT GROUP FINANCIAL HIGHLIGHTS - DKK million

Mill € (recalculated by case authors)	1999	2000	2001	2002	2003
CORE EARNINGS AND PROFIT FOR THE YEAR					
Core income from:					
Lending	321	383	437	464	554
Securities	176	171	183	140	107
Total	497	554	620	604	662
Operating costs, depreciation and amortisation	30	295	31	330	363
Core earnings before write-offs	200	258	313	273	299
Write-offs and provisions for bad and doubtful debts	18	-16	11	23	25
Profit/loss from insurance activities before tax	-1	4	-8	-16	14
Core earnings after write-offs and insurance operations	181	278	29	234	288
Investment portfolio income	82	68	44	98	307
Profit on ordinary activities before tax	263	346	34	332	595
Tax	81	110	92	101	154
Profit for the year	182	236	245	231	441
SUMMARY BALANCE SHEET AT 31 DECEMBER					
Mortgage loans:					
- Nykredit Realkredit	49,966	51,151	53,083	55,388	57,149
- Totalkredit					21,810
Total	49,966	51,151	53,083	55,388	78,959
Total assets	63,583	68,541	77,982	82,779	111,550
Core capital ratio	11.2	12	11.4	11.4	10.1
Average number of full-time staff:					
Nykredit Realkredit and subsidiaries	**2.508**	**2.847**	**2.910**	**3.049**	**3.208**

2003 – IN BRIEF

The Nykredit Realkredit Group's profit before tax is the best results recorded in the history of the Group reflecting a high level of activity, growth and positive results in all business areas of the Group.
Nykredit acquired Denmark's third largest mortgage bank, Totalkredit, and set up a mortgage banking partnership with 105 local and regional banks.
Moody's Investors Service, the credit rating agency, upgraded the rating assigned to Nykredit's mortgage bonds issued out of Capital Centre D to Aaa, the highest possible rating.
Nykredit started lending activities in Poland after the Group's Polish mortgage bank, Nykredit Bank Hipoteczny, received its operational licence in September. In the South of France lending activities also made a good start.
In August Nykredit was the first Danish mortgage bank to launch interest-only mortgages under the Danish brand Pauselån®. Interest in and demand for the new product have been appreciable, and by end-2003 the Nykredit Group had sold approximately 17,000 interest-only mortgages.

For further information on the takeover of Totalkredit see:
http://www.totalkredit.dk/Totalkredit/download.nsf/0/d456ed548404e73fc1256d4b0027a1b6/$FILE/TN_UK.pdf

KEY IT PROJECTS

The development of the production facilities behind interest-only mortgages was an important IT project in 2003. The project resulted in changes and renewals in all parts of Nykredit's production facilities and administration.
With the acquisition of Totalkredit, Nykredit got 105 banks as new partners. In consequence, an Internet solution was developed ensuring that the new sales channel could serve the new partners optimally from day one.
The development and IT activities in 2003 by and large centred round the Nykredit Group's multi-channel strategy and e-business focus. The Group's customer service solution, the CRM system DIALOG (Based on Siebel's systems), was improved both in the marketing and sales areas through several development projects.
Integration components were developed which ensure a safe and effective use of customer data in the various IT systems of the Group in accordance with the customer's consent.
The Internet customer portal My Nykredit has become a platform for e-business. From comprising bank functionality alone, My Nykredit has become a self service channel to Nykredit's customers and a source of overview with respect to statements of account.
Nykredit also initiated a number of new projects in 2003 for the purpose of implementing the future capital adequacy rules laid down by the Basel Committee.
The first project involves a model for the purpose of rating the creditworthiness of corporate customers as part of the credit assessment. As regards credit risks, Nykredit has opted to implement an advanced method.
This places great demands on the system development efforts as far ahead as 2007, but also creates business related advantages.
An intra-group task force has been appointed with a view to developing tools for credit and risk assessment of customers and to enable Nykredit to measure and manage such areas in accordance with the rules of the Basel New Capital Accord.
In 2003 this resulted in the implementation of new credit-related methods and tools.
Since summer 2002 Nykredit's IT operations have been managed by the operations company JN Data in Silkeborg, which is jointly owned by Nykredit and Jyske Bank.

Nykredit Group Structure

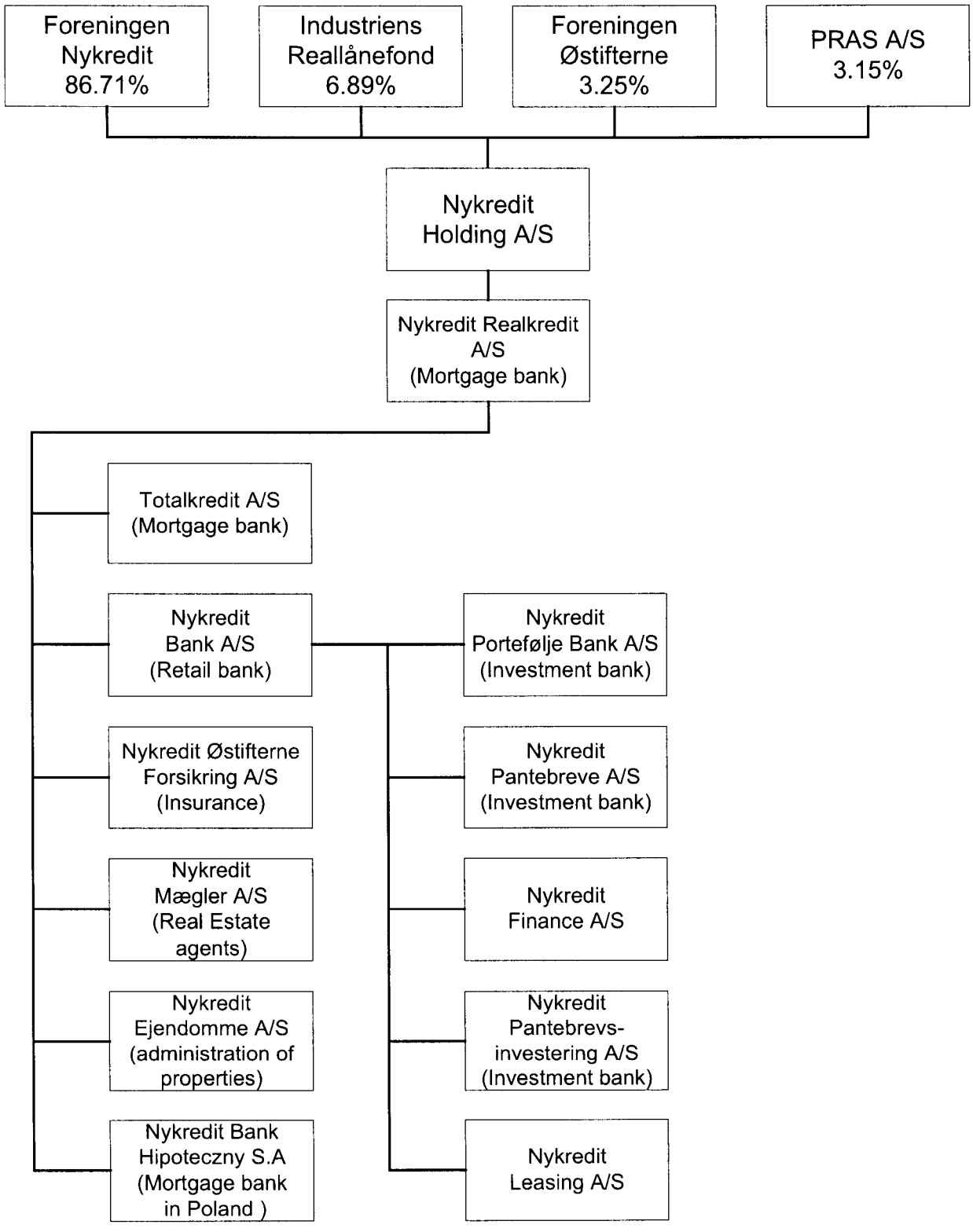

Exhibit 2

Hardware:

Nykredit Group:

Internal users on Nykredit Systems 3.800

Internal net printers 600

Nykredit on the web:

Web visitors per day 10-20.000

Web visitors per week..... 75-100.000

Partners (Using their own hardware):

Bank users on Nykredit Systems 12.000

Real estate users on Nykredit Systems 1.200

Nykredit's share of JN Data A/S*.

Mainframe.....1

Servers.....625

Transactions per day on host / servers .....ca. 2 mill.

Terabyte data on host's disks 5

Number of systems, on Nykredit Data Center 630

Number of programs, on host / servers.....50.000

Number of Database tables (DB2/Oracle) 3.500

Other Data Centers:

Bank systems on BEC**.....80

Insurance systems on FDC***.....10

* JN Data was established by Nykredit and a major Danish bank, Jyske Bank, to handle the IT operation of both companies

** Service bureau owned by a cooperation of small and medium-sized banks.

*** Service bureau owned by mid-sized insurance companies. Nykredit owned 25 percent of this service bureau and a similar share of the systems.