A Study of Software as a Service Business Model

Dan Ma
School of Information Systems
Singapore Management University

Abraham Seidmann
W. E. Simon Graduate School of Business Administration
University of Rochester
Software Delivery Model

Data Centre

Supply Side Resources

- Application
- Computation
- Information, Logical data
- Storage
- Communication

Demand Side Market Segments

- Business 1
- Business 2
- Business 3

Up Front Cost: Purchasing, & implemenetion

Buy my own; Internally support

Pay as I go; External Provider

Usage Based Pricing

Ongoing Maintenance, Support, Delivery

Service Agreement Level Contract
MOTS: The traditional in-house model

• The modifiable off the shelf (MOTS) solution (SAP, GE PACS, Siebel CRM, …)
  – requires an upfront (software and hardware) purchase
  – located on user’s site
  – high degree of customization/integration
  – requires in-house on going IT support
SaaS: the shared IT business model

• **Software as a Service:** “software on-demand”
  – No upfront purchase required
  – Located at centralized cloud/ data center facility of an external provider
  – Limited customization
  – The external provider deals with maintenance, data management, and all necessary IT support

• **From the economic perspective:**
  – User shared business structure
    one-provider-to-many-customers
  – On-demand payment scheme
    pay as you go
In-house MOTS vs. Shared SaaS?
* Focus on comparative cost
* Typical cost decomposition

<table>
<thead>
<tr>
<th></th>
<th>In-house MOTS</th>
<th>SaaS</th>
</tr>
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<tbody>
<tr>
<td><strong>Initial license fee</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Modification fee</strong></td>
<td>Yes</td>
<td>No</td>
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<tr>
<td><strong>Customization fee</strong></td>
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<td>No</td>
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<td>Yes</td>
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<tr>
<td><strong>Initial consultation fee</strong></td>
<td>Yes</td>
<td>No</td>
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<tr>
<td><strong>On-going support cost</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Pay per month</strong></td>
<td>No</td>
<td>Yes</td>
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Source: from our discussions with end users in Singapore, 2010
### Logistic firm with 40 people

* They need an SME accounting package

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<tr>
<td>Initial license fee</td>
<td>S$20,000</td>
<td>0</td>
</tr>
<tr>
<td>Modification fee</td>
<td>S$500 (per doc)</td>
<td>0</td>
</tr>
<tr>
<td>Customization fee</td>
<td>S$1,000 (per doc)</td>
<td>0</td>
</tr>
<tr>
<td>Integration fee</td>
<td>S$15,000</td>
<td>0</td>
</tr>
<tr>
<td>Initial consultation fee</td>
<td>S$50 (per hour; min 5 hours)</td>
<td>0</td>
</tr>
<tr>
<td>On-going support cost</td>
<td>S$2,000 (per month; per person)</td>
<td>0</td>
</tr>
<tr>
<td>Pay per month</td>
<td>0</td>
<td>S$49 / 99/ 199/ 299* (per month)</td>
</tr>
</tbody>
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* The price depends on the customer’s choice. For example, S$49 per month allows up to 10,000 transaction lines per month; and S$299 per month gives unlimited transaction lines.
Cost comparison: the accounting software*

• The in-house system
  The customer chooses to
  • modify 5 documents
  • customize 2 documents
  • requests a minimal time of initial consultations
  • hires 1 IT person for internal support.
  
  **Total cost ➔ S$159,750**

• The SaaS solution
  • No modification or customization
  • The customer chooses the most expensive services (gives unlimited number of use per month)
  
  **Total cost ➔ S$11,940**

*Here, the total costs are calculated in a 5-year length period. The comparison result always holds, independent of the calculation length.*
The comparative cost analysis ignored the “lack-of-fit”

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</tr>
<tr>
<td>Customization fee</td>
<td>“Gives a “perfect-fit” system”</td>
<td>No</td>
</tr>
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<td>Integration fee</td>
<td>Yes</td>
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What is the value of the right fit?
What is the penalty cost of “lack-of-fit”?
The research analysis

The purpose of the research is to understand the following in the setting of software delivery decisions

- Users’ Adoption (yes or no, how, when)
- Vendors’ competition (pricing strategy, targeted market segments)
- Costs, benefits, risks and profitability

The SaaS vendor

Competition

The MOTS In-house vendor

End users (firms in need of enterprise software)
Modeling End Users

- The heterogeneous firms
  - different usage and stochastic demand

User \{i\} located at \(d_i\):

\[ D_i \sim \text{Uniform} \left[ d_i - \theta, d_i + \theta \right] \]
Modeling the MOTS Solution

The MOTS in-house Vendor

Initial implementation/customization/installation $C_{MOTS}$

Upfront purchase payment $P_{MOTS}$

The User $d_i$

Stochastic demand

Purchases internal IT infrastructure (capacity) $q^*$ at unit infrastructure cost $\{c\}$;

On-going service cost per transaction $\{c_1\}$

Created value: $u / \text{transaction}$

The red dot indicates the location of the system.
Modeling the SaaS Solution

The SaaS

service cost \( \$c_2 / \text{transaction} \)

Delivers services

Pays a price \( \$ P_a / \text{transaction} \)

\( d_i \)

\( (\text{Stochastic demand}) \)

Created value: \( \$(u-t) / \text{transaction} \)

\( t: \) the “lack-of-fit” cost <-> the disutility incurred when you do not get what exactly you need;
Higher \( t \) means that SaaS option incurs high lack-of-fit cost/higher disutility for the user.
The MOTS-only Market
(The Benchmark Case)

• Only one MOTS solution is available
• MOTS provider sets its price
• User firms decide whether to purchase and install the system
  – Yes: install in-house IT capacities $q^*$ bears over- and under-capacity risk
  – No: stay out of the market
Optimal In-house IT Capacity
(The Benchmark Case)

- User \( \{i\} \) determines optimal in-house service capacity \( \{q_i^*\} \):

\[
\begin{align*}
\text{Max} \quad E \left[ (u - c_1)^* \min \{D_i, q_i\} - P_{MOTS} - cq_i \right] \\
= \Pr\{D_i > q_i\} (u - c_1)q_i + \Pr\{D_i \leq q_i\} (u - c_1) E[D_i / D_i \leq q_i] - P_{MOTS} - cq_i \\
\Rightarrow q_i^* = d_i + \theta \left( 1 - \frac{2c}{u} \right)
\end{align*}
\]

- \( u \) Utility/transaction for user under MOTS solution ($/transaction)
- \( c \) Unit capacity cost
- \( c_1 \) Unit service cost
- \( P_{MOTS} \) One-time price paid to the MOTS vendor
- \( D_i \) Transaction volume of user \( \{i\} \). (a random variable)
- \( d_i \) Expected transaction volume of user \( \{i\} \), \( E[D_i] = d_i \)
- \( \theta \) Volatility range of users’ transaction volume
The Marginal MOTS User
(The Benchmark Case)

At the optimal capacity level \( \{q_i^*\} \), the expected utility for user \( \{i\} \) is

\[
Eu_{MOTS}(d_i) = d_i(u - c_1 - c) - P_{MOTS} - \frac{c(u - c)}{u} \theta
\]

Users with non-negative utility will purchase and install the system.

The user with expected transaction volume \( \{d^M\} \) is the marginal user:

\[
Eu_{MOTS}(d^M) = 0 \Rightarrow d^M = \frac{P_{MOTS}}{u - c - c_1} + \frac{c(u - c)}{u(u - c - c_1)} \theta
\]
The Optimal MOTS Price (The Benchmark Case)

- The threshold policy market coverage

$$\text{Max } \prod_{\text{MOTS}} = (P_{\text{MOTS}} - C_{\text{MOTS}})(1 - d^M)$$

$$\Rightarrow P_{\text{MOTS}}^M = \frac{C_{\text{MOTS}}}{2} + \frac{(u - c - c_1)}{2} - \frac{(u - c)c}{2u}$$
The Market Segment
(The Benchmark Case)

- Low-transaction-volume users out of market
- Users and MOTS vendor share the capacity risks
Competition Between MOTS and SaaS (The Dual Market)

• Both SaaS and MOTS software solutions exist in the market.

• The SaaS and MOTS providers set their prices simultaneously.

• Users choose the SaaS, the MOTS, or staying out of the market.
The Indifferent User
(The Dual Market)

- Given prices \( \{P_{MOTS}, p_a\} \), the user \( \{i\} \) chooses between:

\[
Eu_{MOTS}(d_i) = d_i(u - c_1 - c) - P_{MOTS} - \frac{c(u - c)}{u} \theta
\]

\[
EU_{SaaS}(d_i) = (u - t - p_a)d_i
\]

The user with expected transaction volume \( d^* \) is the indifferent user who gains the same utility from both models:

\[
d^* = \frac{P_{MOTS}}{p_a + t - c} + \frac{c(u - c)}{u(p_a + t - c)} \theta
\]
The Price Competition
(The Dual Market)

- The MOTS vendor determines the optimal selling price $\left\{ P_{MOTS}^* \right\}$

$$\max_{P_{MOTS}} \prod_{MOTS} = (P_{MOTS} - C_{MOTS})(1 - d^*)$$

- The SaaS determines the optimal price/transaction $\left\{ p_a^* \right\}$

$$\max_{p_a} \prod_{SaaS} = (p_a - c_2)\int_0^{d^*} x dx$$

- The equilibrium price pairs are

$$P_{MOTS}^* = \max\left\{ C_{MOTS}, \frac{C_{MOTS}}{2} + (c_2 + t - c - c_1) - \frac{(u - c)c}{2u} \theta \right\}$$

$$p_a^* = \max\{ c_2, \min\{ u - t, 2c_2 + t - c - c_1 \} \}$$
Four Outcome Regions
(depending on $t$)

- Critical values of $t$:
  \[ t_1 < t^* < t_2 \]

$t$ (lack-of-fit)

1. Low
   - SaaS dominates.
   - Effective Competition from SaaS

2. $t_1$
   - Both business models coexist.
   - Both business models coexist.

3. $t^*$
   - Effective Competition from SaaS
   - Ineffective Competition from SaaS

4. High
   - In-house dominates.
Region 1 & 4: One business model dominance

**SaaS dominance requires:** \[ t < t_1 \]

With the very low lack-of-fit cost, SaaS price is reduced to a very low level, and SaaS product becomes very attractive. Together, it could drive the MOTS solution out of the market.

**MOTS dominance requires:** \[ t > t_2 \]

With the very high lack-of-fit cost, SaaS price reaches its upper bound, and SaaS product becomes very unattractive. The SaaS vendor therefore is not able to make non-zero profit even when MOTS still charges the monopoly price.
Four Outcome Regions
(depending on $t$)

- Critical values of $t$: $\{t_1 < t^* < t_2\}$

$\begin{array}{c}
\text{SaaS dominates.} \\
\text{In-effective Competition from SaaS}
\end{array}$

$\begin{array}{c}
\text{Both business models coexist.} \\
\text{Effective Competition from SaaS}
\end{array}$

$\begin{array}{c}
\text{In-house dominates.} \\
\text{In-effective Competition from SaaS}
\end{array}$
Region 2: Effective Competition

**Effective competition requires:** \( \{ t_1 \leq t \leq t^* \} \)

**MOTS-only market**

- Use the MOTS software at \( \{ P_{MOTS}^M \} \)
- Expected transaction volume

**Dual market**

- Use the SaaS

- MOTS market share, price, and profit are reduced.
- Full market coverage is achieved.
- Three market segmentation; all users are better off.
Region 3: Ineffective Competition

*Ineffective, infra-marginal competition*:
\[
\{ t^* \leq t \leq t_2 \}
\]

- MOTS-only market
- Out of the market
- Dual market
- Use the SaaS
- Use the MOTS software at $P^M_{\text{MOTS}}$
- Expected transaction volume

- Full market coverage is achieved.
- MOTS market share, price and profit are not affected.
- No competition takes place between the two vendors.
- The SaaS has non-zero profit; extracts all potential utility value from users.
The Complete Competition Diagram

- Critical values of $t$: \( \left\{ t_1 < t^* < t_2 \right\} \)

The SaaS’s ability to compete in the market \textit{monotonically increases} as the parameter \( \{t\} \) decreases.
Additional Market Factors

- The volatility of transaction volume:
  
  *As the transaction volume uncertainty level ($\theta$) increases:*

  => *more users will opt for SaaS*

- IT transaction volume:
  
  *As the transaction volume ($d_i$) increases:*

  => *more users will opt for MOTS.*

- IT infrastructure (capacity) costs:
  
  *As the capacity cost ($c$) increases:*

  *more users will opt for SaaS.*
Competition with Dynamic Unfit Costs

Unfit costs \(( t )\) may change over time.

- Unfit costs increase
  
  *eg. software or hardware changes on the users’ side*
  
  *evolving business demand*

- Unfit costs decrease
  
  *eg. technology improvements leading to enhanced across-application integration ability*
  
  *development of a uniform platform for software (such as AppExchange by Salesforce.com)*
Competition with Dynamic Unfit Costs

**A competitive model in longer time frame**

In the first stage, unfit costs = \( \{t_1\} \)

- the vendors choose their prices simultaneously.
- users choose one software vendor

In the second stage, unfit costs increase to \( \{t_H\} \) or decrease to \( \{t_L\} \)

- users consider switching from the current software vendor to the other
- switching costs \( \{E\} \)
When Unfit Costs \((t)\) Decrease:

\[ d_1 \quad d_s \quad \text{Expected transaction volume} \]

0 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad

Users choose the SaaS initially and stay with the SaaS afterwards.

Users choose the MOTS software initially, and switch to the SaaS in the second stage.

Users choose the MOTS software initially and stay with the MOTS afterwards.

\( d_s \) Indifferent user between staying with the MOTS or switching to the SaaS, given it has chosen the MOTS in the first stage.

\( d_1 \) Indifferent user between the SaaS and MOTS at time 0, after considering the possibility of later switch.
When Unfit Costs ($t$) **Increase:**

\[ \begin{align*}
&D_S \\
&0 \\
&\text{Users choose the SaaS initially and stay with the ASP afterwards.} \\
&D_1 \\
&1 \\
&\text{Users choose the MOTS software initially and stay with the MOTS afterwards.} \\
&\text{Expected transaction volume} \\
\end{align*} \]

- $d_S$: Indifferent user between staying with the SaaS or switching to the MOTS, given it has chosen the SaaS in the first stage.

- $d_1$: Indifferent user between the SaaS and MOTS at time 0, after considering the possibility of later switch.
Interesting Findings (I)

- When users anticipate a future decrease of lack-of-fit costs ($t_1 \rightarrow t_L$):*
  - SaaS will decrease its price;
  - MOTS will decrease its price;
  - the MOTS’ price is the same as in the static competition with $t=t_1$;
  - In the second stage, existing MOTS users will switch to the SaaS **only if** their transaction volatility is large;

*These observations are based on the comparison to the benchmark “static” case without changes in lack-of-fit costs.
Interesting Findings (II)

• When users anticipate a future increase of lack-of-fit costs \((t_1 \rightarrow t_H)\):*

  – SaaS will increase its price;
  – MOTS will increase its price;
  – the MOTS’ price is the same as in the static competition with \(t=t_H\);
  – In the second stage, existing SaaS users switch to the MOTS;

* These observations are based on the comparison to the benchmark “static” case without changes in lack-of-fit costs.
Conclusions and Major Contributions

• We Analyze the SaaS from the competitive standpoint.
• Study the multiple aspects of the value chain
  – Marketing: pricing competition
  – Operation: capacity management
  – IT: IT outsourcing & IT in-house (CIO’s perspective)
• Identify: “market segmentation.”
• Suggest: “software segmentation.”
• Predict the future of software industry.
• Show how users beliefs do influence the SaaS in a significant way.
• Suggest proper pricing strategies in a long time window, under users’ certain expectations about the software future quality change.
Questions?

Thanks a lot