



# CS207 #4, 16 Oct. 2009

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Gates B12



## Admin notes:

- New Sign-up sheets –  
prior entries have been transferred
- No grade option this time, only S/NC
  1. I didn't read the fine print
  2. Can sign up for extra units as directed reading
  3. I will in any case provide feedback on reports
- One student is **not on the registrar's list**
- Next year the course will likely be cross-listed in MS&E



# Syllabus:

1. Why should software be valued?
2. Open source software. Scope. Theory and reality
3. Principles of valuation. Cost versus value.
4. Market value of software companies.
5. **Alternate business models.**
6. Intellectual capital and property (IP).
7. Life and lag of software innovation.
8. Sales expectations and discounting.
9. **The role of patents, copyrights, and trade secrets.**
10. **Licensing.**
11. **Separation of use rights from the property itself.**
12. **Risks when outsourcing and offshoring development.**
13. **Effects of using taxhavens to house IP.**



# Example

## Software product

7 versions

- Sells for \$500/copy
- Market size 200 000
- Market penetration 25%
- Expected sales 50 000      50 785 V1-V7
- Expected income \$25M
- Discounted gross income \$14.7M
- Available for SW maintenance \$3.7M
  - ❑ Ok but not when needed

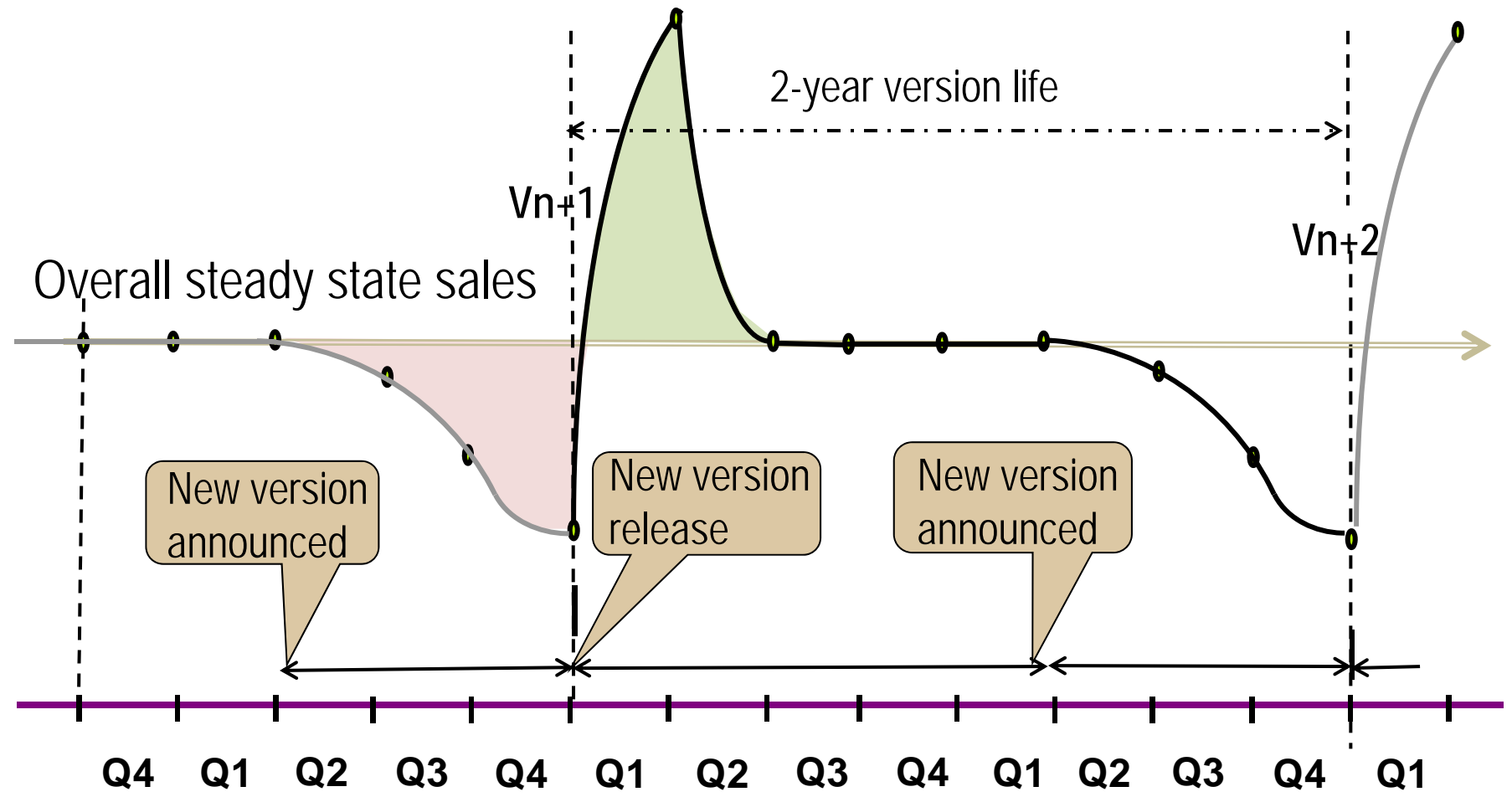
# Combining it all

corrected see spreadsheet

<i>factor</i>	<b>today</b>	y1	y2	y3	y4	y5	y6	y7	y8	y9
Version	1.0	2.0		3.0	4.0		5.0	6.0		7.0+
unit price	\$500	500	500	500	500	500	500	500	500	500
Rel.size	1.00	1.67	2.33	3.00	3.67	4.33	5.00	5.67	6.33	7.00
New grth	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00
replaced	0.00	0.05	0.08	0.12	0.15	0.18	0.22	0.25	0.28	0.32
old left	1.00	0.95	0.92	0.88	0.85	0.82	0.78	0.75	0.72	0.68
Fraction	100%	57%	39%	28%	22%	17%	14%	11%	9%	8%
Units sold	0	1911	7569	11306	11395	8644	2646	1370	1241	596
Rev, \$K	0	956	3785	5652	5698	4322	2646	1370	620	299
SWIP25%	0	239	946	1413	1424	1081	661	343	155	75
Due old	0	136	371	416	320	204	104	45	18	6
Disct 15%	1.00	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28, 0.25
Contribute	0	118	276	263	178	94	40	15	6	2
<b>Total SW</b>	<b>990</b>	≈ \$ 1 million out of \$14 771 discounted sales								

# Transients due to versions

Customer behavior w.r.t. new versions, superimposed on basic sales curve





# Result of Example

- Selling 50 000 SW units at \$500  $\approx$  \$ 1M in a typical product situation.

To be wise, don't spend more than  $\approx$  \$500 000 to develop the software product.

Need some capital for corrective maintenance before sales kick in



# Income Factors

1. Business overhead takes 50% of net revenue
  - An average, when sales are low, fraction is higher
  - Be lean, especially when sales fall
  - Focus on on-line sales
2. Marketing uses 25% of net revenue
  - Assess customer base, but don't skimp here
3. Available for maintenance is still 25% of net
  - Enough once sales become substantial
  - Requires additional capital initially





# Guidance obtained

- We applied an overall Erlang sales curve
  - new versions keep market going but customers do not replace earlier versions
- The assumption are sufficiently simple that alternatives can be intelligently discussed
  1. keep development costs low
  2. design so that SW maintenance is low
  3. charge a higher price
  4. minimize sales cost, without reducing market size
  5. broaden the market
  6. or →



# Business models

0. New versions do not replace earlier versions

Alternative business models

1. New versions encourage replacement

2. Provide related services

3. Charge for maintenance

Lower initial cost, slower income stream

4. Make product Open source to broaden market

Charge only for services



# Alternate business model

Consider maintenance and its income

"Service model"

- More assumptions – now include cost @50% of value
  1. Original cost \$500 000 (used to estimate 2.)
    - a. Maintenance cost 15%/year of aggregate original cost
    - b. Maintenance fee 15%/year of original price, 1 year delay.
    - c. 85% annual retention of customers.
  2. Maintenance Lag =  $\Delta (t \text{ cost} , t \text{ income}) = 1 \text{ year}$
  3. Stop maintenance when cost > income

# Additional Effect of service model

factor	today	y1	y2	y3	y4	y5	y6	y7	y8	y9
Version	1.0	2.0		3.0	4.0		5.0	6.0		7.0
Org.cost \$K	500	Assume designed for maintenance								
Maint.cost	0	75	86	99	114	131	151	174	200	230
Spending	75	86	99	114	131	151	174	200	230	Σ1523
SW@Cust.	0	812	4475	9456	13735	15997	16243	15176	13520	11744
Maint.Fees	0	0	122	671	1419	2060	2060	2400	2437	2277
Total income	0	956	3906	6324	7116	6382	5045	3806	2897	2380
Contribute @25	0	239	977	1581	1779	1569	1261	952	724	570
Unspent SW	-75	153	877	1467	1648	1445	1088	752	495	306
Unspent Disc.	-75	133	663	965	942	718	470	162	87	40
Total	4 348	≈ \$ 4.3 million >> sales only but \$1 523M for maintenance								

Cost of maintenance =  $1523 / (500 + 1523) = 75\%$  of total

typical



# Service model factors

- Same proportion was used for SW contribution: 25%
  - Maintenance income has lower sales cost, perhaps more should be made available for software improvements
- Discount total only after maintenance cost
  - Income comes at time of spending
- Maintenance fees still generate substantial income
  - Organize business sector to collect those in out years
  - Use excess SW income for replacement or new products
- Continue longer, but stop in time!
  - When maintenance costs more than income

# More years of service model ?

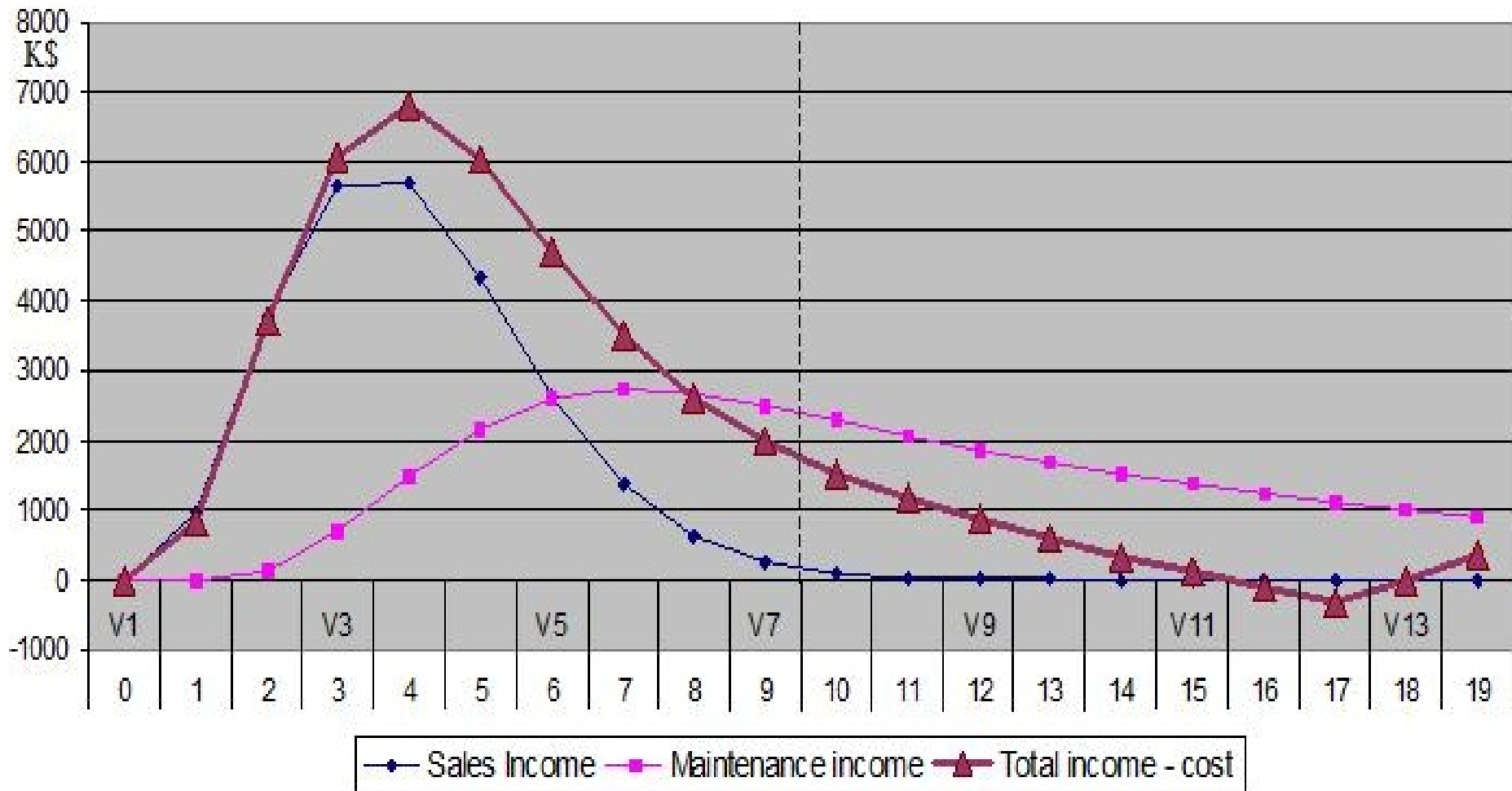
factor	Cont.	y10	y11	y12	y13	y14	y15	y17	y17	y18
Version	7.0	8.0		9.0	10.0		11.0	12.0		13.0
Curr.cost \$K	1530									
Maint.cost	229	264	303	349	401	461	530	610	702	540
Spending	264	303	349	401	461	530	610	702	540	
SW@Cust.\$M	11.7	10.1	8.6	7.3	6.2	5.3	4.5	3.8	3.2	1.9
Maint.Fees	2038	1761	1511	1289	1098	933	794	674	573	487
Total income	2280	1855	1543	1300	1101	934	794	674	573	487
Contribute @25	570	464	386	325	275	234	198	169	143	122
Unspent SW	306	160	40	-76	-186	-297	-411	-533	-397	-145
Unspent Total	2015	1551	1194	898	639	404	184	-27	32.6	221
Unspent Disc.	-75	133	663	965	942	718	470	162	87	40
Total sw	4 158	Less, out year losses because \$5 687M spent on maintenance								

Good time to quit

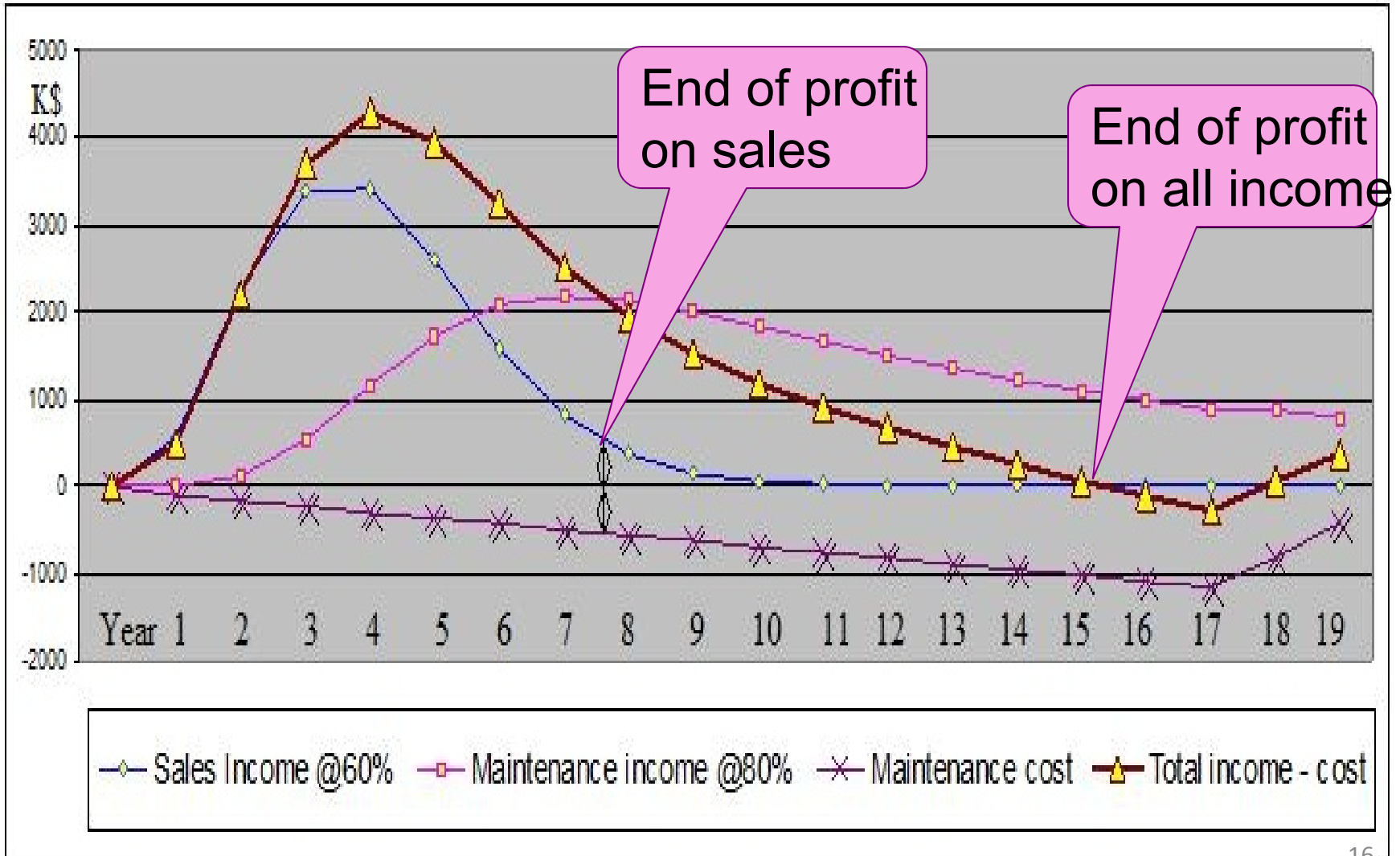
But still have income to v12

Quit: reduce expense & income 1/3 each year

# Total income vs technical cost

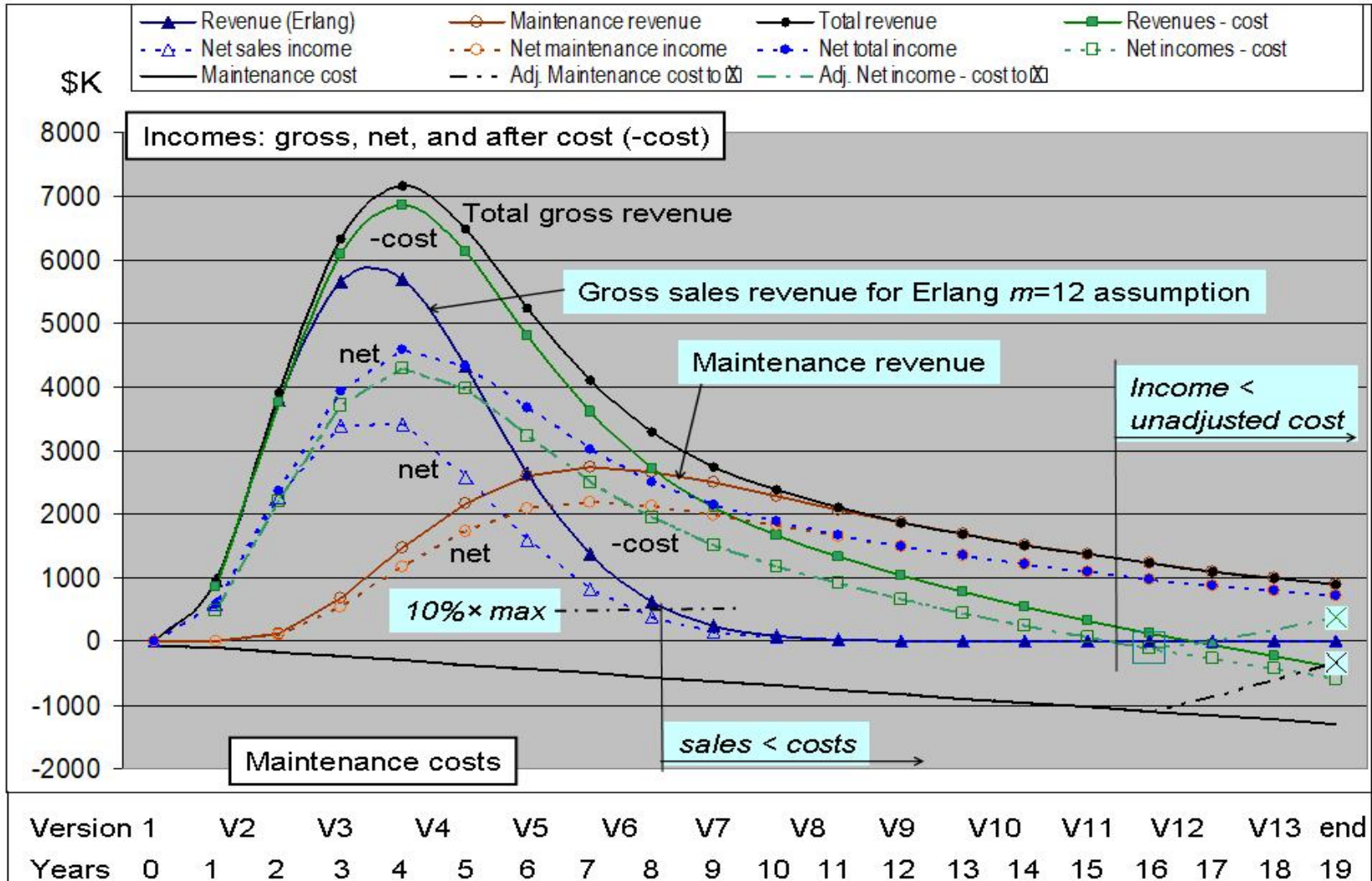


# Net income, after sales cost





# All Graphs





# Service model

Analysis shows » profitability in service model

- To achieve such a beneficial model
  1. Management must value maintenance
  2. Marketing and sales must provide feedback
  3. Education and training must recognize the value of maintenance and maintainability
- Often ignored today
  1. Academics don't teach it (3/850 pages [Pressman:01])
  2. Companies give maintenance tasks to novices
    - Experienced programmers should maintain their work



# Life of Software

We learned now why software has a finite life

Although SW can be indefinitely maintained

***Eventually the maintenance costs exceed income***

- A very well-selling product can have a long life
  1. Unique
  2. High quality
  3. Well maintained
- An easy to maintain product can have a long life
  1. Well designed
  2. Insulated from change by established standards



**Conflict?**

# Seasonal trends

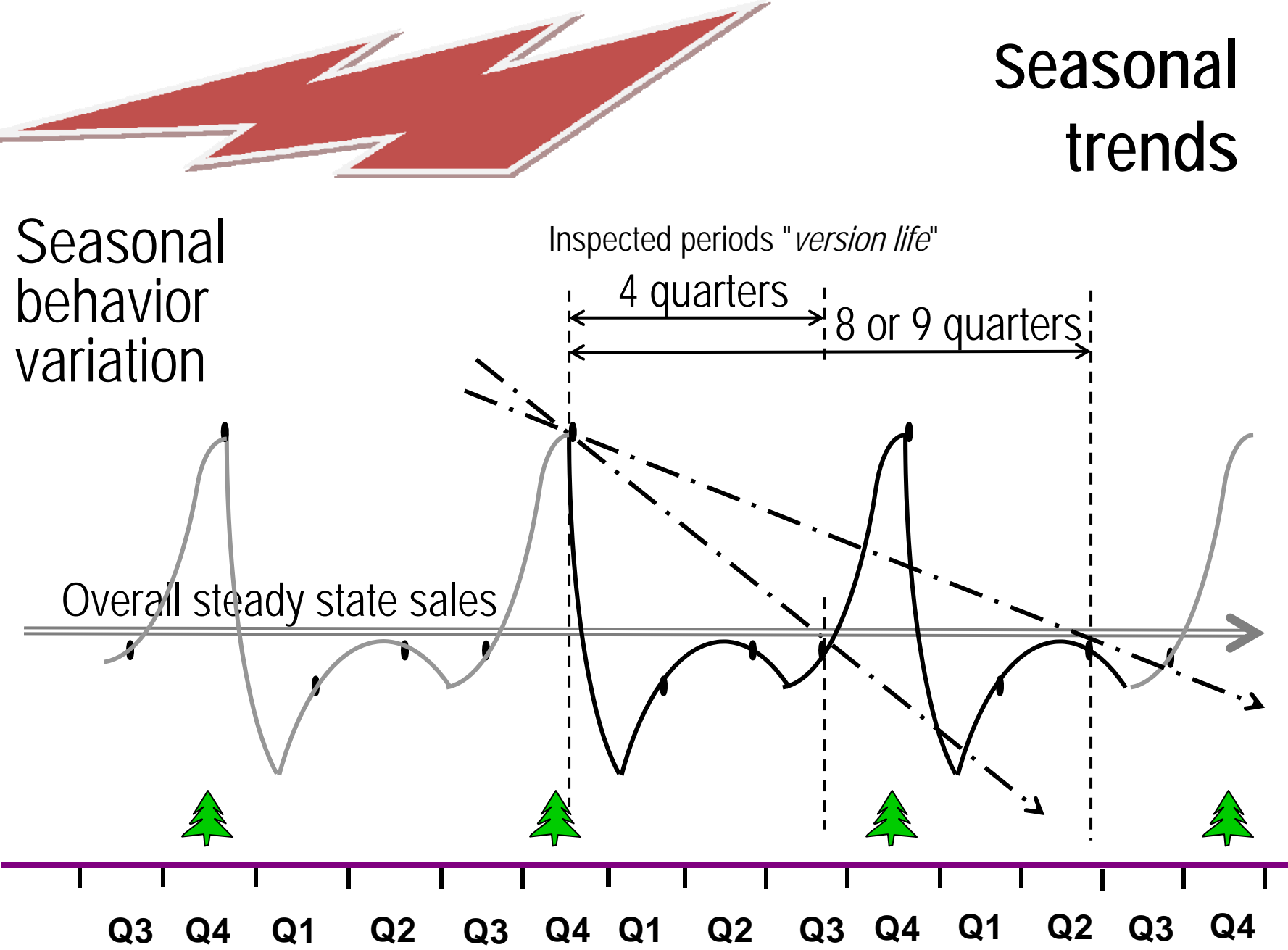
Seasonal behavior variation

Inspected periods "version life"

4 quarters

8 or 9 quarters

Overall steady state sales





# Software users & IP

Companies that

1. develop & sell software



- Basis of IP: income from sales

2. purchase & license software for internal use

- Do not generate IP with software

3. develop software internally for their own use

- Basis of IP: relative SW expense × all income

4. combinations



# Allocaction

- When there are multiple products
- When there are other contributors to income
  - Substantial hardware
  - Financial consultants in financial firms
  - Experts in call centers
  - Brand name

Not all of the income can be allocated to the software
- Pareto Optimum



# Pareto Optimality

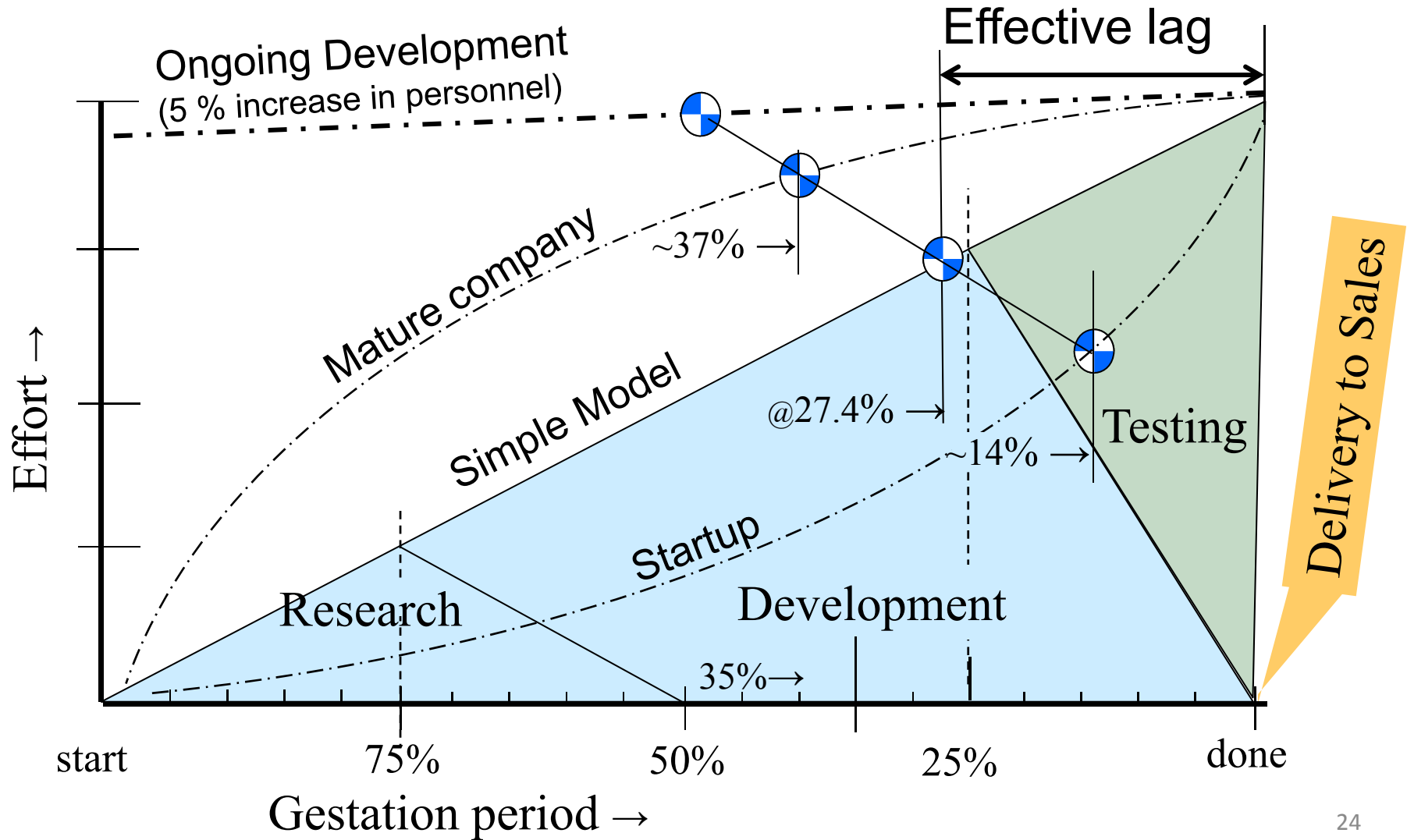
The point where any change lowers the total

- Spending more on software will have less benefit than spending on other stuff
  - People
  - Hardware
  - Advertising
    - For large 10 IT companies the average value allocated to their brand name is 22% (BW survey).

Conclusion:

- If a company is managed optimally, we can allocate IP contribution by multi-year spending patterns

# Lag delays benefits of R&D investments







# Discussion

- Many choices now
  - a. Technical
  - b. BusinessInteract with each other.