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Develop High Performance Web App

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Agenda

- Intel on HTML5
- Optimize Web App
  - Methodology
  - Case Study
  - WAPA

Intel on HTML5

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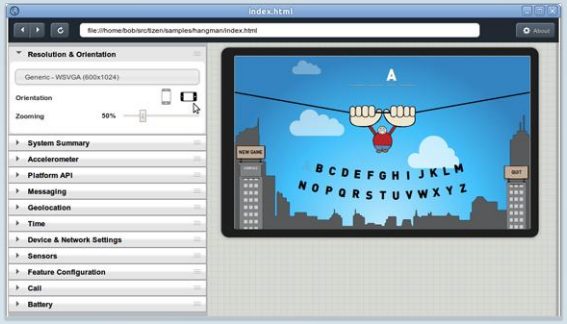
HTML5 becomes a key element of the next era of computing

Intel Commit to Provide Best HTML5 Experience

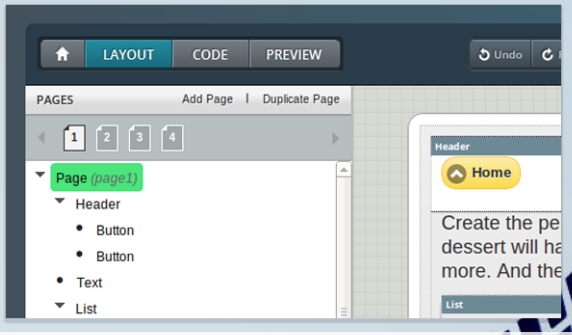
Collaborate with leading Web browser vendors

- **750+** patches to Webkit in the last 2 months
- the **2nd largest contributor** to Chromium behind Google*

- HTML5 and EcmaScript implementations – WebRTC, RiverTrail etc.
- Open source tools on **01.org** – Web Simulator, RIB etc.



Web Simulator



RIB (Rapid Interface Builder)

Intel HTML5 Toolkit Introduction

Software

Intel App Framework

jqMobi
A fast query selector library

jqUI
Cross platform UI library

jqPlugin
Plugins to augment applications

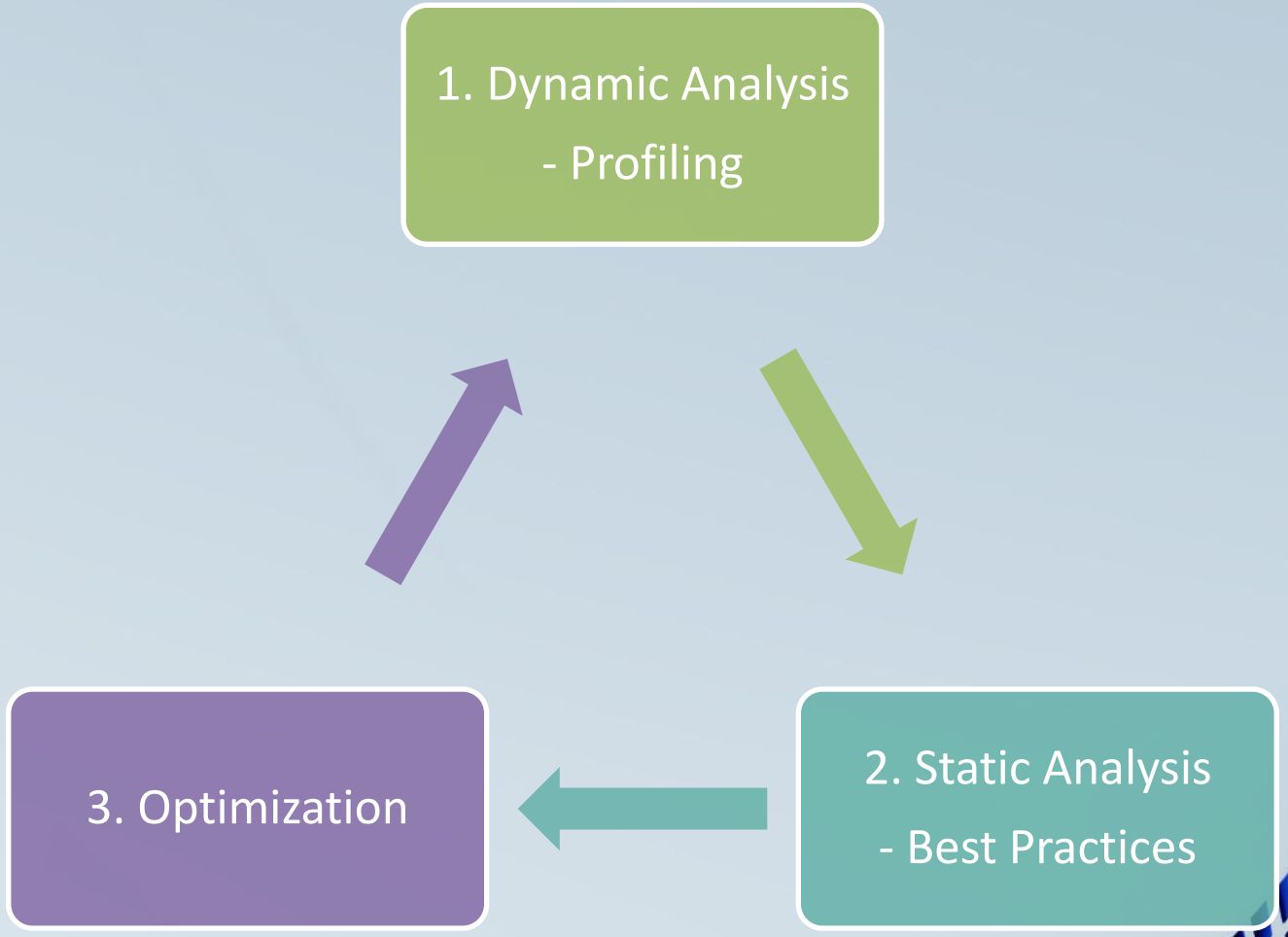
badoo

PayPal

COLLEGE PROWLER

Optimize Web App - Methodology

General Optimization Methodology



Optimize Web App

Application Level

- Loading efficiency
- Slow APIs
- Cache
- Language characteristics

Library Level

- Query selector
- DOM manipulation
- Event binding

Web Runtime Level

- Rendering engine
- JS engine

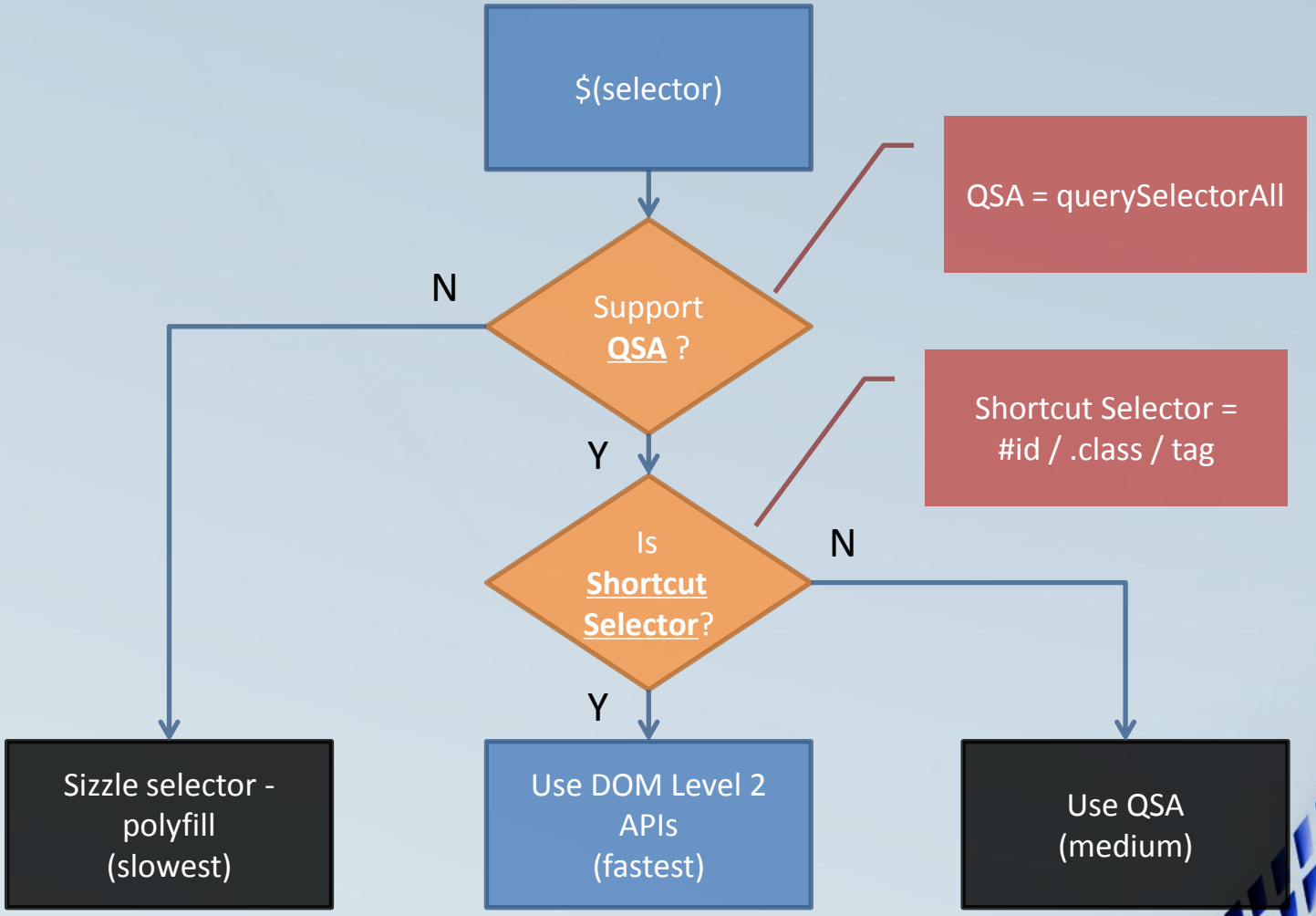
Optimize Web App - Case Study

Case Study 1 – jQuery Selector

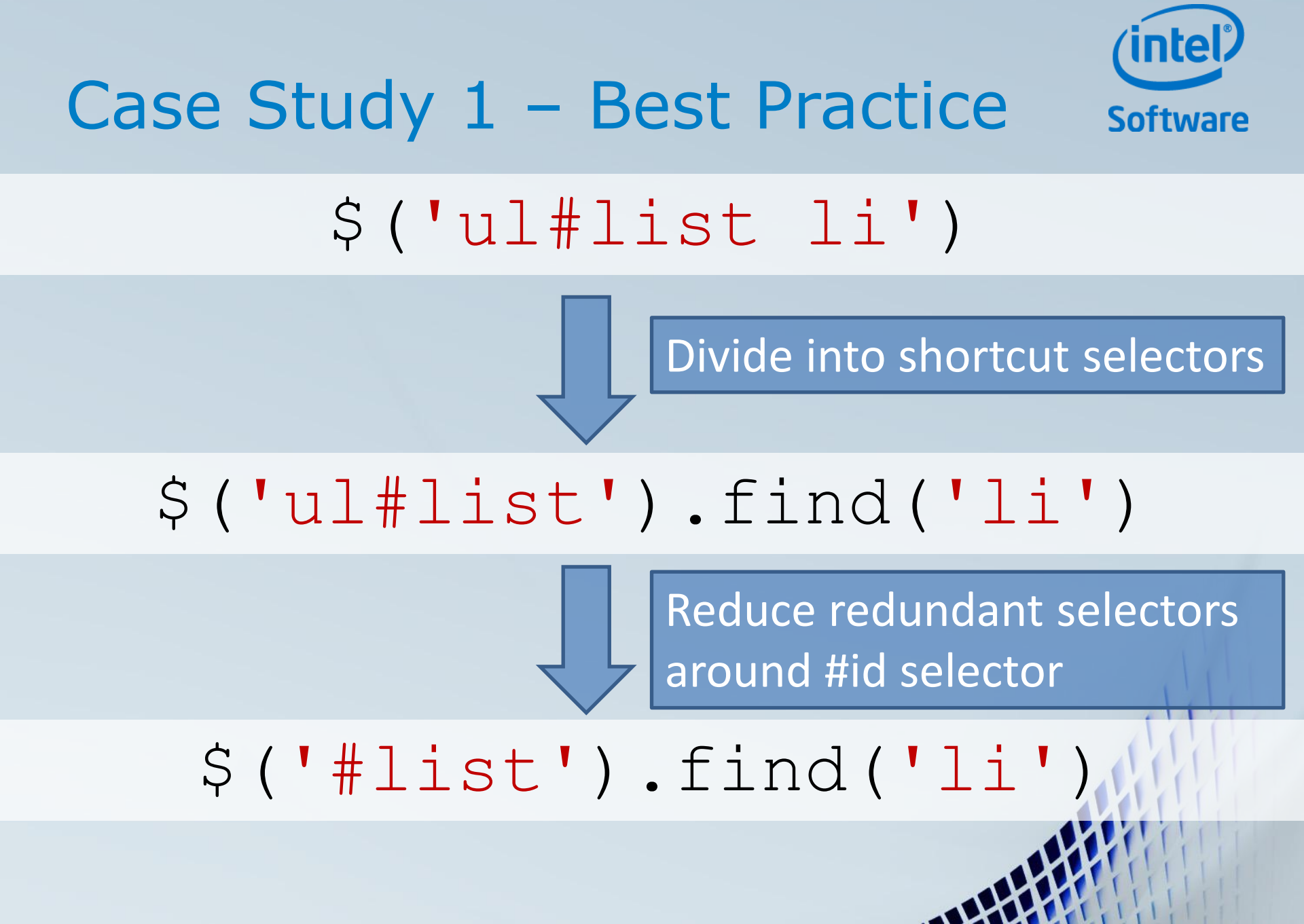
Pattern 1	`$('ul#list li')`	1.0x
Pattern 2	`$('li','#list')`	1.6x
Pattern 3	`$('#list').find('li')`	1.9x
Pattern 4	`$('ul#list').find('li')`	1.2x

http://jsperf.com/jquery-selector-case-1/2

Case Study 1 – Root Cause



Case Study 1 – Best Practice

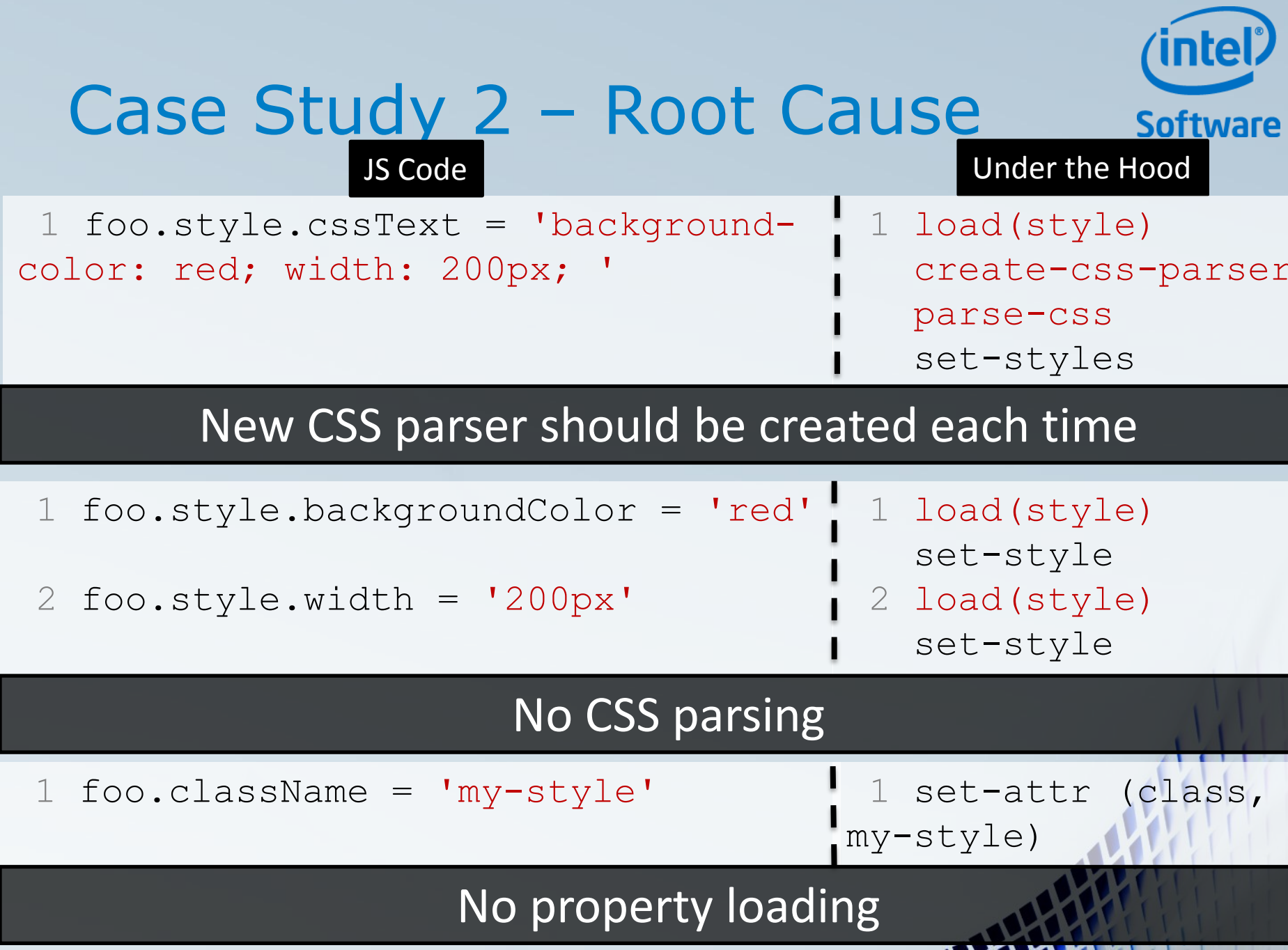


Case Study 2 – Static Style

Pattern 1	`foo.style.backgroundColor = 'red'` `foo.style.width = '200px'`	1.0x
Pattern 2	`foo.style.cssText = 'background-color: red; width: 200px; '`	0.2x
Pattern 3	`foo.classList.add('my-style')`	2.2x
Pattern 4	`foo.className = 'my-style'`	2.4x

http://jsperf.com/css-style-case-2/2

Case Study 2 – Root Cause



Case Study 2 – Best Practice

```
foo.style.backgroundColor = 'red'
foo.style.width = '200px'
```

Use className property

```
foo.className = 'my-style'
```

Case Study 3 – Global Variable

Pattern 1	`self.v += 1`	1x
Pattern 2	`obj.v += 1`	21x
Pattern 3	`v += 1`	23x

http://jsperf.com/closure-case-3/2

Case Study 3 – Root Cause

JS Code	Under the Hood
`1 self.v += 1;`	`1 load-named-generic_runtime (v)` `Add (v, 1)`

JIT call runtime to load global property variable

`1 obj.v += 1;`	`1 cmp [ecx+0xff], obj_hidden_class`
	`jnz Bailout`
	`mov edi,[ecx+property_offset]`
	`Add (v, 1)`

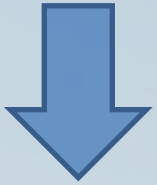
Hidden class speeds up property access

`1 v += 1;`	`1 load-global-cell(v)`
	`Add (v, 1)`
	`store-global-cell(v)`

Even faster access through closure variable

Case Study 3 – Best Practice

```
self.v += 1
```



Store values in normal object

```
obj.v += 1
```

Store values in closure variable

```
v += 1
```

Case Study 4 – Cache Closure Variable

Pattern 1

```
var v;
function NoCache() {
  for (var i = 0; i < 10000; i++)
    v += i;
}
```

1.0x

Pattern 2

```
var v;
function Cache() {
  var local = v;
  for (var i = 0; i < 10000; i++)
    local += i;
  v = local;
}
```

5.7x

http://jsperf.com/cache-variable-into-local

Case Study 4 – Root Cause

JS Code

```
1 var v;
2 function NoCache() {
3   for (var i = 0; i < 10000; i++)
4     v += i;
5 }
```

Under the Hood

```
1
2
3 for loop
4   load-global-cell(v)
    Add(v, i)
    store-global-cell(v)
5
```

Load/Store global cell for each loop

```
1 var v;
2 function Cache() {
3   var local = v;
4   for (var i = 0; i < 10000; i++)
5     local += i;
6   v = local;
7 }
```

```
1
2
3 load-global-cell(v)
4 for loop
5   Add(local, i)
6 store-global-cell(v)
7
```

Load/Store global cell only once

Case Study 4 – Best Practice


```
var v;
function Cache() {
  var local = v;
  for (var i = 0; i < 10000; i++)
    local += i;
  v = local;
}
```

Cache closure variables into local & batch operations

Case Study 5 – With Statement

Software

Pattern 1	`with (obj) { v += 1; }`	1.0x
Pattern 2	`obj.v += 1;`	42x

http://jsperf.com/with-statement-case-4

Case Study 5 – Root Cause

JS Code

```
1 with (obj) {
2   v += 1;
3 }
```

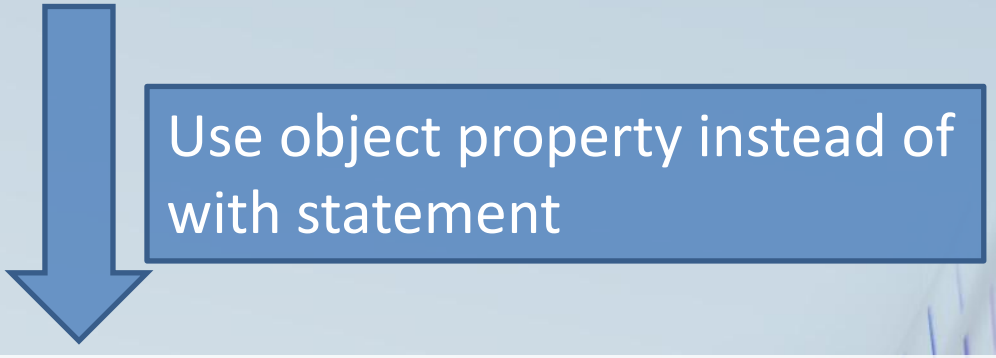
Under the Hood

```
1
2 if (obj.v === undefined) {
      v = v + 1;
  } else {
      obj.v = obj.v + 1;
  }
3
```

JS engine cannot optimize so many possibilities for each variable access

Case Study 5 – Best Practice

```
with (obj) {
   v += 1;
}
```

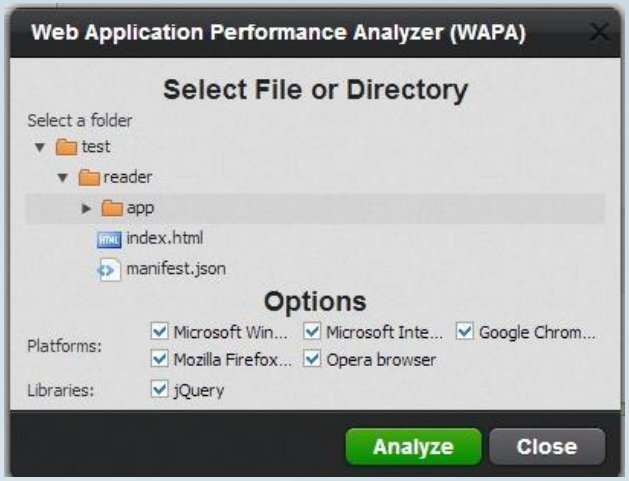


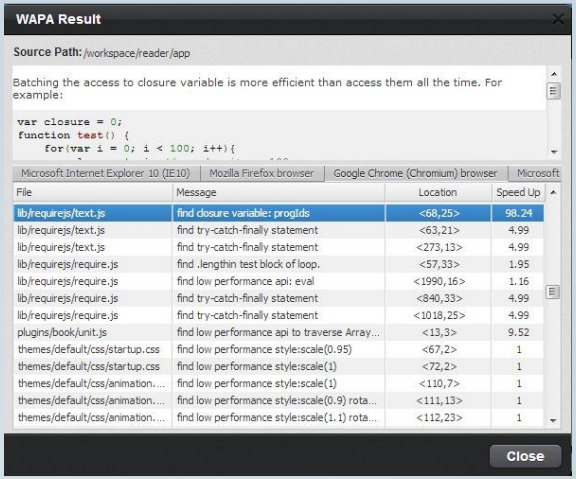

```
obj.v += 1;
```

Optimize Web App - WAPA

WAPA

- ***W***eb ***A***pplication ***P***erformance ***A***nalyzer
- Statically analyze web applications
- Based on micro-benchmarks and best practices



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Backup

Case Study – Negative

Pattern 1

```
function abs(x) {
  return x > 0 ? x : -x;
}
```

1.0x

Pattern 2

```
function abs(x) {
  return x >= 0 ? x : -x;
}
```

1.1x

http://jsperf.com/negative

Case Study – Children Nodes

Pattern 1

```
var children = parentNode.childNodes;
for (var i = 0, len = children.length;
  i < len; i++) {
  handleNode(children[i]);
}
```

1.0x

Pattern 2

```
var child = parentNode.firstChild;
while (child) {
  handleNode(child);
  child = child.nextSibling;
}
```

1.4x

http://jsperf.com/childnodes-vs-nextsibling

Case Study – String Join

Pattern 1

```
var str = sArr.join("");
```

1.0x

Pattern 2

```
var str = "";
for (var i = 0, length = sArr.length;
i < length; i++) {
  str += sArr[i];
}
```

4.1x

http://jsperf.com/stringconcatanation/2

Case Study - Reflow

Pattern 1

```
target.style.width =
  source.clientWidth + 'px';
target.style.height =
  source.clientHeight + 'px';
```

1.0x

Pattern 2

```
var clientWidth = source.clientWidth;
var clientHeight = source.clientHeight;
target.style.width = clientWidth + 'px';
target.style.height = clientHeight + 'px';
```

1.8x

http://jsperf.com/reflow-matters