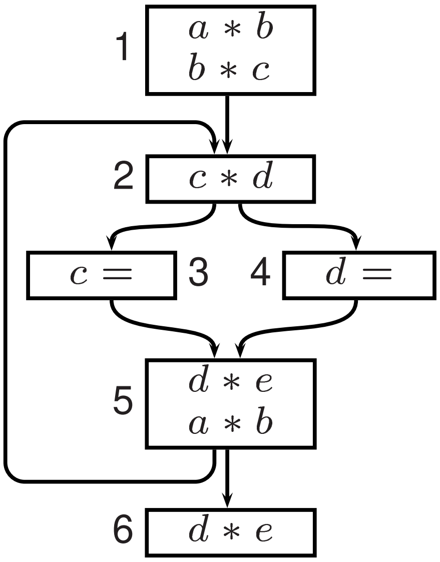
Available Expressions Analysis : An Example

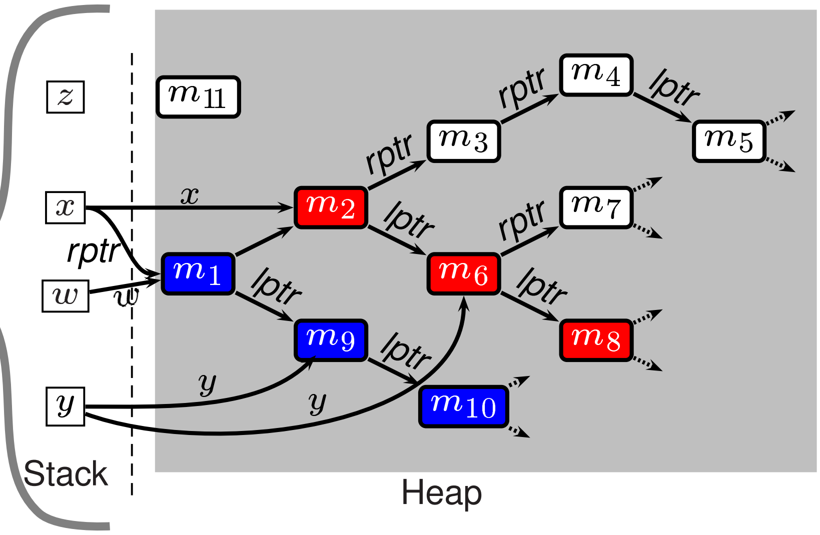


Let $e_1 \equiv a * b$, $e_2 \equiv b * c$, $e_3 \equiv c * d$, $e_4 \equiv d * e$

Node	Expressions Computed	Expressions Available (At entry)	Redundant Expressions
1	$\{e_1, e_2\}$	$\{\}$	$\{\}$
2	$\{e_3\}$	$\{e_1\}$	$\{\}$
3	$\{\}$	$\{e_1, e_3\}$	$\{\}$
4	$\{\}$	$\{e_1, e_3\}$	$\{\}$
5	$\{e_1, e_4\}$	$\{e_1\}$	$\{e_1\}$
6	$\{e_4\}$	$\{e_1, e_4\}$	$\{e_4\}$

Liveness of Heap Data

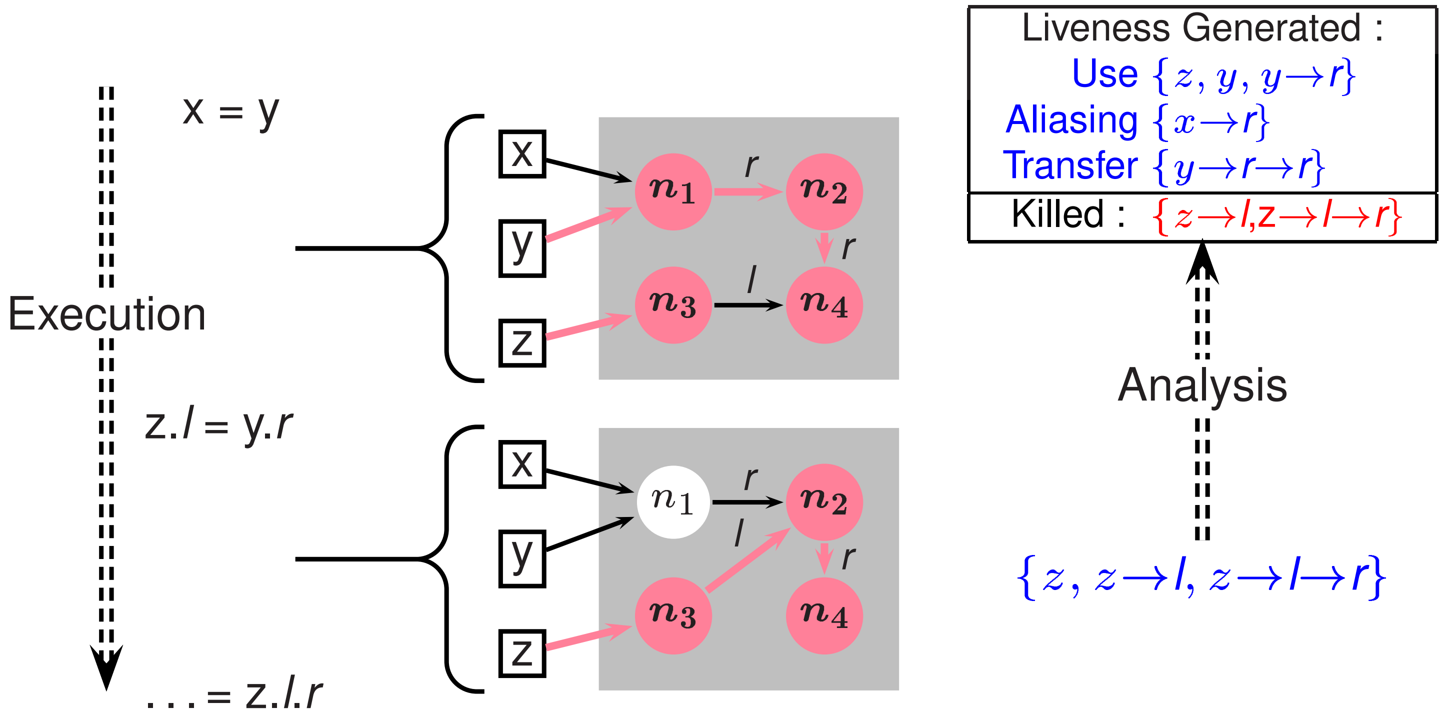
$w = x$ // x points to m_1
if $(x.data < max)$
  $x = x$.rptr
$y = x$.lptr
$z =$ new ...
$y = y$.lptr
$z.sum = x.getdata()$
  $+ y.getdata()$



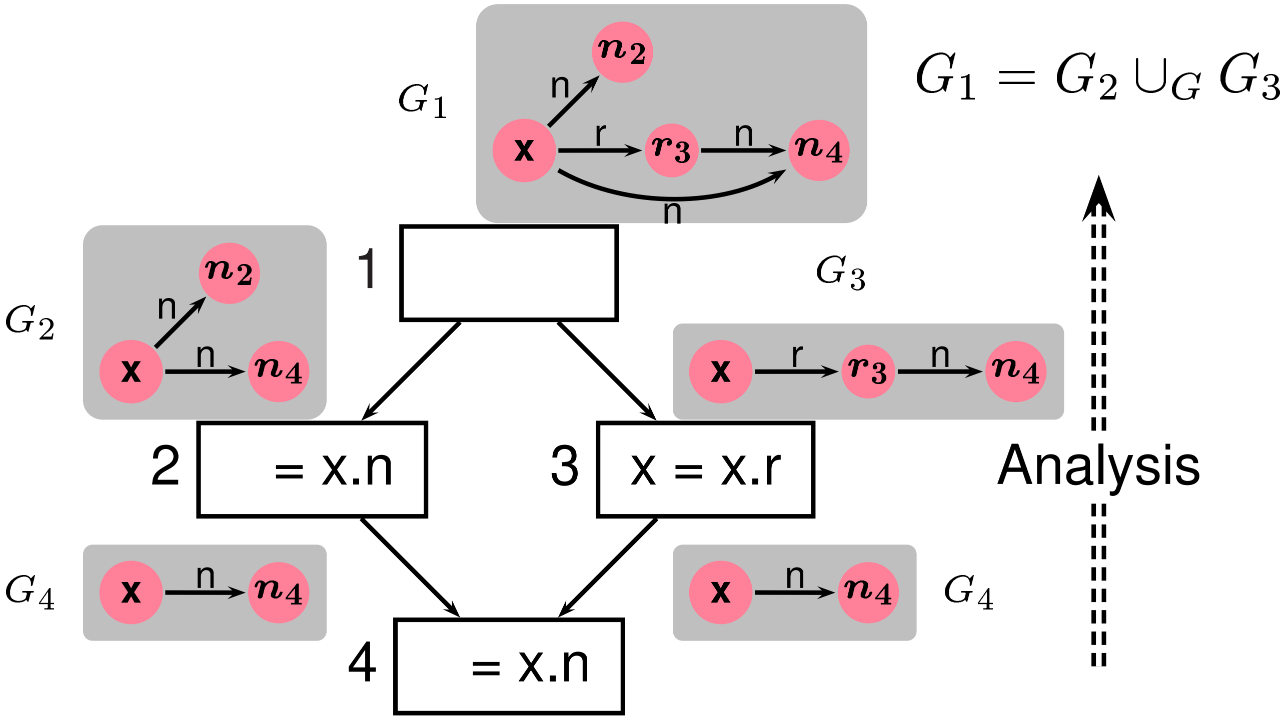
If $(x.data < max)$ Red nodes are used otherwise Blue nodes are used.

All other nodes are unused and should be considered garbage.

Effect of an Assignment

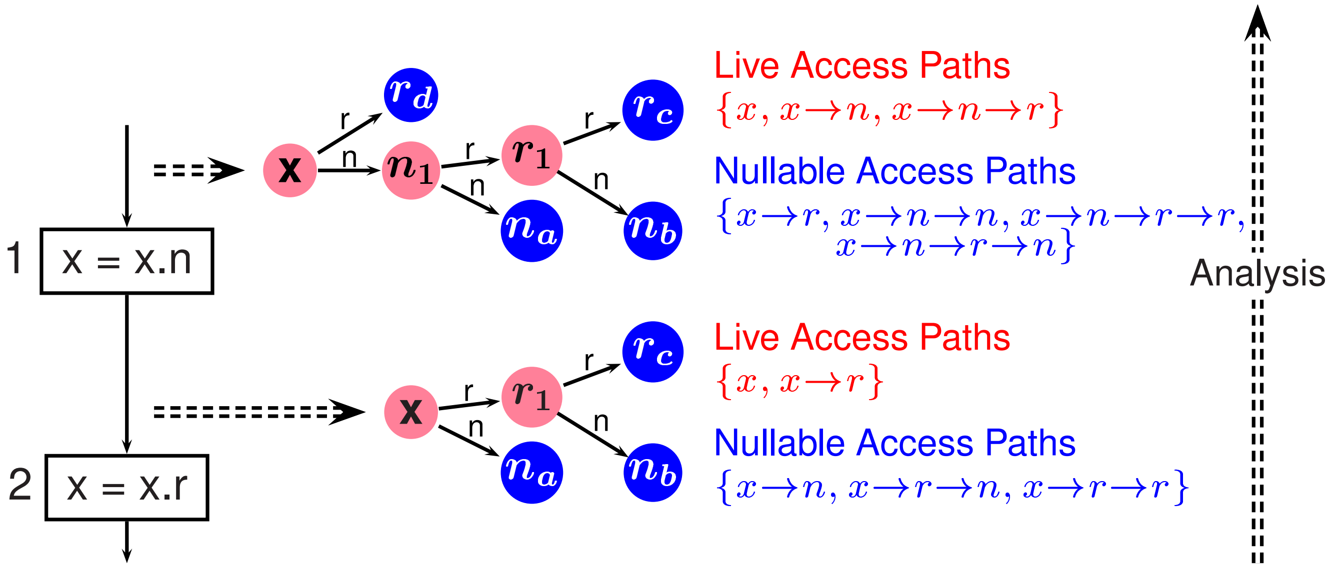


Merging Data Flow Information



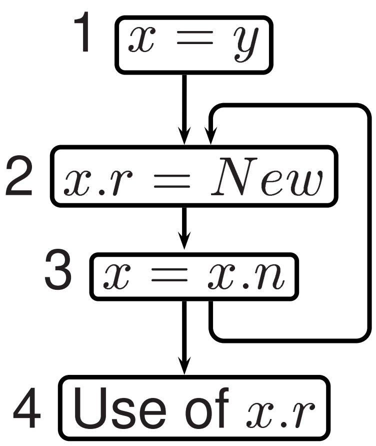
Nullability Analysis

- Add *Potentially Nullable* nodes to access graphs

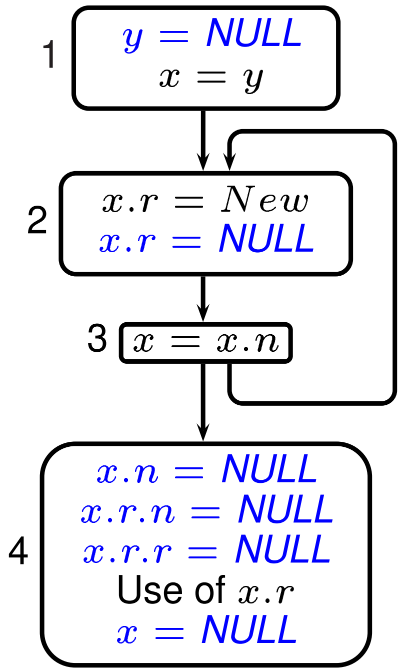


Examples of Instrumentation

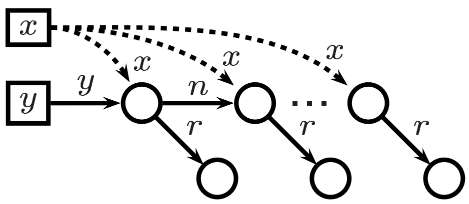
Original Program



Instrumented Program



Memory



Using This Technology as a Stand Alone Tool