Structured vs. Unstructured Grids

The choice of whether to use a structured or an unstructured mesh is very problem specific (as well as company/lab specific). The answer is one of engineering judgement. Here are some of the issues:

(1) Complex geometry: unstructured grid generation is usually much faster than structured grid generation. However, if the geometry is only slightly modified from a previously existing geometry with a structured grid, then structured grid generation can occur very rapidly.

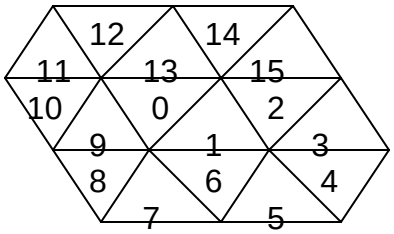
For a problem which is different from previous applications:
Structured grid: $\approx$ man weeks to 1 man month
Unstructured: $\approx$ man hours to a few days

(2) Accuracy: For simpler problem such as airfoil (single element) or an isolated wing, structured grids are generally more accurate per unknown than unstructured. However, for more complex flows, the adaptivity facilitated by an unstructured grid may allow more accurate solutions.

(3) Convergence CPU time: structured grid calculations usually take less time than an unstructured grid calculation because, to date, the existing algorithms are more efficient.

$i-1$	$j+1$	$i+1, j+1$	$i+1 j+1$
$i-1 j$	ij	$i+1 j$	
$i-1 j-1$	$ij-1$	$i+ij-1$	

$U(i, j) \Leftarrow$ data stored in a "2-D" array



$U(i) \Leftarrow$ data stored in a "1-D" array

So, in order to calculate a residual for all, the neighboring states must be known.
Structured: neighbors found by adding/subtracting 1 from cell indices.

Unstructured: requires storage of cell-to-cell pointers.

$\Rightarrow$ More storage, slower execution of code.