

$$\begin{array}{ccc}
 x(t) & \xrightarrow{\text{Velocity } u(x,t)} & x(t+dt) \\
 \bullet & & \bullet \\
 x(t+dt) = x(t) + dt u(x,t) & &
 \end{array}$$

$$y(t+dt) = y(t) + dt u(y,t)$$

$ \begin{aligned} u(y,t) &= u(x+y-x,t) \\ &= u(x,t) + (y-x) \cdot \nabla u \end{aligned} $

$$\begin{array}{ccc}
 y(t) & \xrightarrow{\text{Velocity } u(y,t)} & y(t+dt) \\
 \bullet & & \bullet
 \end{array}$$

Subtracting red from green:

$$\begin{aligned}
 s(t+dt) &= s(t) + dt s \cdot \nabla u \\
 \text{where } s &= y-x
 \end{aligned}$$