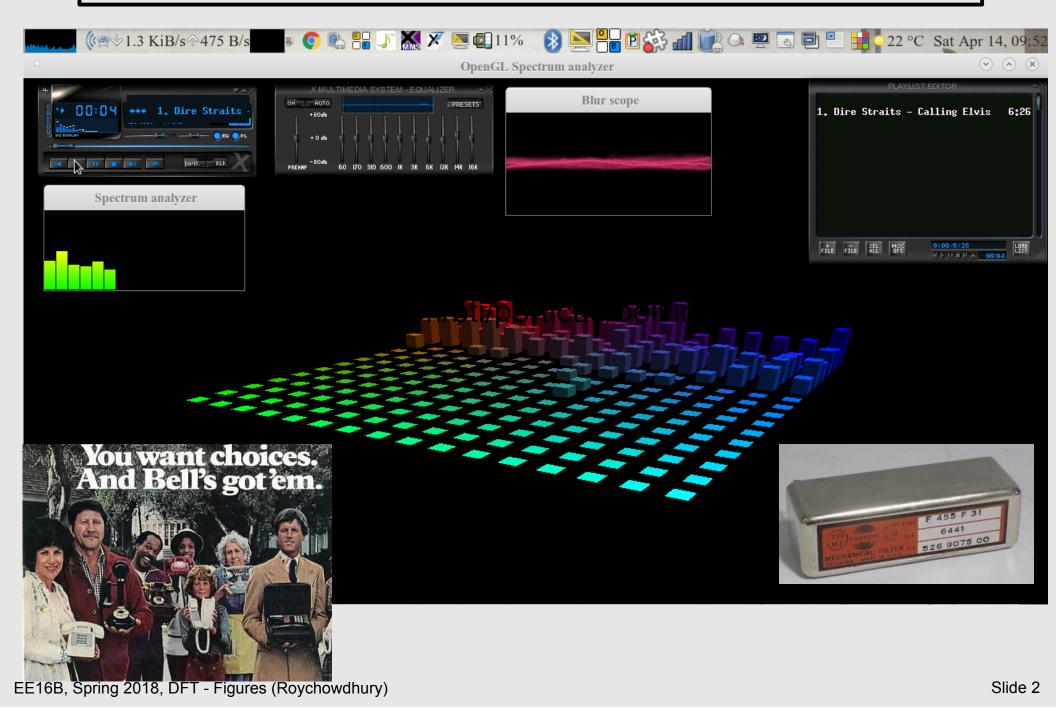
EE16B, **Spring 2018 UC Berkeley EECS** Maharbiz and Roychowdhury Lecture 13A Signals **Discrete Fourier Transform (DFT)**

Audio DSP: powered by the DFT



JPEG images: powered by DCTs

JPEG quality: 98



DCT vs DFT

DCT-II [edit]

$$X_k = \sum_{n=0}^{N-1} x_n \cos igg[rac{\pi}{N} \left(n + rac{1}{2}
ight) k igg] \qquad k=0,\ldots,N-1.$$

The DCT-II is probably the most commonly used form, and is often simply referred to as "the DCT".^{[1][2]}

This transform is exactly equivalent (up to an overall scale factor of 2) to a DFT of 4N real inputs of even symmetry where the even-indexed elements are zero. That is, it is half of the DFT of the 4N inputs y_n , where $y_{2n} = 0$, $y_{2n+1} = x_n$ for $0 \le n < N$, $y_{2N} = 0$, and $y_{4N-n} = y_n$ for 0 < n < 2N. DCT II transformation is also possible using 2N signal followed by a multiplication by half shift. This is demonstrated by Makhoul.