Continuous SE:
(Supplementary Material 1)

CS350

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Software Industry Evolution

Up to 2005

- SW dev. life cycle was slow
- Embedded SW was dictated by dev. cycle for HW
- SW was treated as one of components; the system dev. Cycle treated all components equally

After 2005

- SW dev. life cycle gets faster
- Frequency of SW release has been increasing.
- Now, some companies are releasing even many times per day.
- Even systems with more critical functionality start to release quite often.

Software-Intensive System Industry

Before 2005

- SW was a very small part of embedded system
- Product
- Maximize product sales for more profits

After 2005

- Telecom: 80% R&D for SW
- Automobile: 70% innovation is SW related
- Service or Product&Service
  - Ex: car sharing in big cities
  - Ex: Jet engines as a service where airlines pay by flight hour.
- Fewer products, longer life time of products
  - How? Deploy new versions of SW that increase capabilities of products already deployed

Additional Changes

- Everything is connected (IoT)
  - Cars, consumer electronics, etc
- Connected SW-intensive products allow for deployment of new SW after the product leaves the factory.
- Embedded systems are able to collect data about their functioning and the way in which they are used by customers and unprecedented insight into product performance, use, and context in which the products are deployed.
- Referred as "……."

Changing Practice of Building SW

Traditional SW Dev.

- Producing intermediate artifacts such as requirements, designs, code, testing results
- Problems:
  - Significant time delay
  - Significant amount of resources
  - Significant local optimization

New Paradigm Adoption Steps

- Agile practice in R&D organization
  - Small, empowered teams, backlog, daily scrum, etc
- Continuous integration
  - Test-driven dev. by agile teams
  - Automated build
  - Quality requirements
- Continuous deployment
  - After passing the continuous testing, SW is deployed to customers
- Frequent deployment of SW to customers
  - for continuous testing of new features and optimization of existing features
  - "if it hurts, do it often

New Trends Disrupting Traditional SW Dev.

- For SW development, from being an activity defined by an organization's internal processes and practices towards becoming an activity characterized by open innovation and co-creation of value
- Fast changing and unpredictable market needs, complex and changing customer's requirements, shorter time-to-market
  - Growing importance of SW
  - *Customer* expectation of responsiveness
- Connectivity available to virtually all embedded systems