

# SEI and Software Modernization

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Software Engineering Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213

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# The SEI is a DoD R&D Federally Funded Research and Development Center



Established in 1984 at Carnegie Mellon University

~615 employees (ft + pt), of which about 70% are engaged in technical work

Initiated CERT cybersecurity program in 1988

Primary offices in Pittsburgh and DC, with several operating locations near customer facilities

About \$150M in funding (~\$20M DoD Appropriated Line)

# Examples of SEI Work



# Federal Example #1

## The setting

- Mission critical (24x7x365) IT system
  - >5M LOC COBOL, hierarchical DB, mainframe
- Prior effort modernized < 25% of functionality
- Planning a new modernization effort, possibly to the new architecture

## How SEI helped

- Recovered and evaluated the architecture
- Led an analysis of alternatives among five trajectories
- Led migration planning (including data migration)

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
		R1 Specific Questions													
Q1 Migrate Hierarchical DB DB		Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
Q2 Migrate Application Code		Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
Q3 Integration & Testing		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
Q4 Application Maintenance		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
Q5 Acquisition & Contracting		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
Q6 Past Performance		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
		Technical Approach Analysis Framework													
F1 Code		Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
F1 Design / Analysis	Data	Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
F1 Design / Analysis	Docs	Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
F2 Migration Code, Data, Infra (Q1 & Q2)		Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red
F3 Integ & Test (Q3)		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
F4 Sync & Cutover	Sync	Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
F4 Sync & Cutover	Cut	Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
F5 App Maintenance (Q4)		Green	Green	Green	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Yellow	Red	Yellow	Red
Approach 1-4		1	3	2	2	2	4	4	4	2	2	1	1	4	4
		Cost and Timeframe ROMS													
Cost (ROM)	\$ Mil	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Timeframe (ROM)	Months	24	18	24	24-48	24	24	24	12	9-12	24	24	24	24	24

# Federal Example #2

## The setting

- Large-scale IT ecosystem for data sharing comprises highly interconnected systems and databases that are overly complex, costly to maintain, and do not facilitate extensibility.

## How SEI helped

- Evaluated organizational capabilities (e.g., acquisition, governance, and operational environments)
- Recovered and evaluated the architecture
- Led development of a future technology roadmap
- Mentoring initial implementation of the roadmap and establishing technical governance groups

# Architecture Done Incrementally

Bolsa Mexicana de Valores (BMV) operates the Mexican Financial Markets on behalf of the Mexican government.

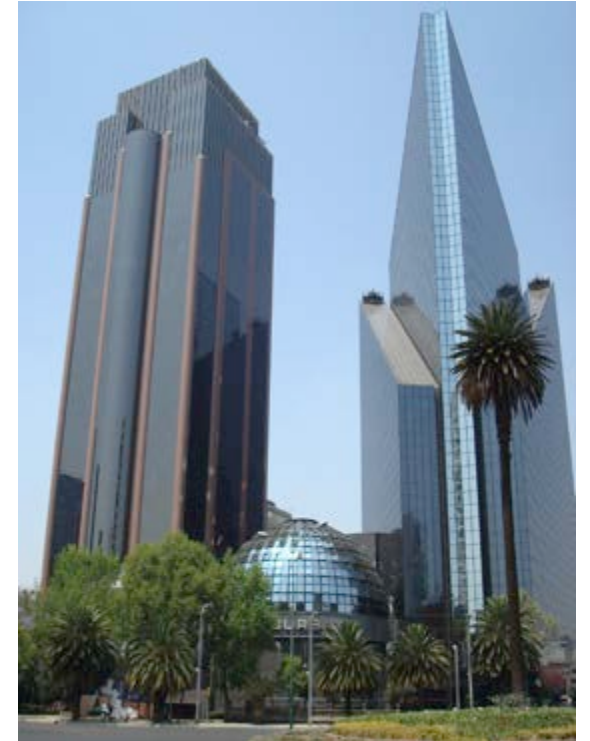
- Bursatec is the technology arm of the BMV.

BMV desired a new stock trading engine to drive the market.

- BMV performed a build vs. buy analysis and determined that Bursatec would replace their three existing trading engines with one in-house developed system.

Bursatec committed to deliver a trading engine in 8-10 quarters.

- High performing
- Reliable and of high quality
- Scalable



“Integrate End to End Early and Often”, by Bachmann, Carballo, McHale, and Nord. *IEEE Software*, July-Aug 2013.

# Bursatec Results

The system had significantly improved quality attribute response times developed within budget with a junior, inexperienced team.

Results	Target	Actual
Latency	1ms	0.1ms
Throughput (transactions per second)	1,000	200,000
Schedule (months)	18	17
Quality (defects/KLOC found during validation testing)	0.25	0.1

# Modernization Project Observations

# Common Modernization Drivers

Reduce O&M costs resulting from increasing difficulty in maintaining, modifying, or extending the system

Mitigate an impending loss of critical knowledge and skills

Improve cybersecurity posture

Adopt modern technologies, practices, and tool chains

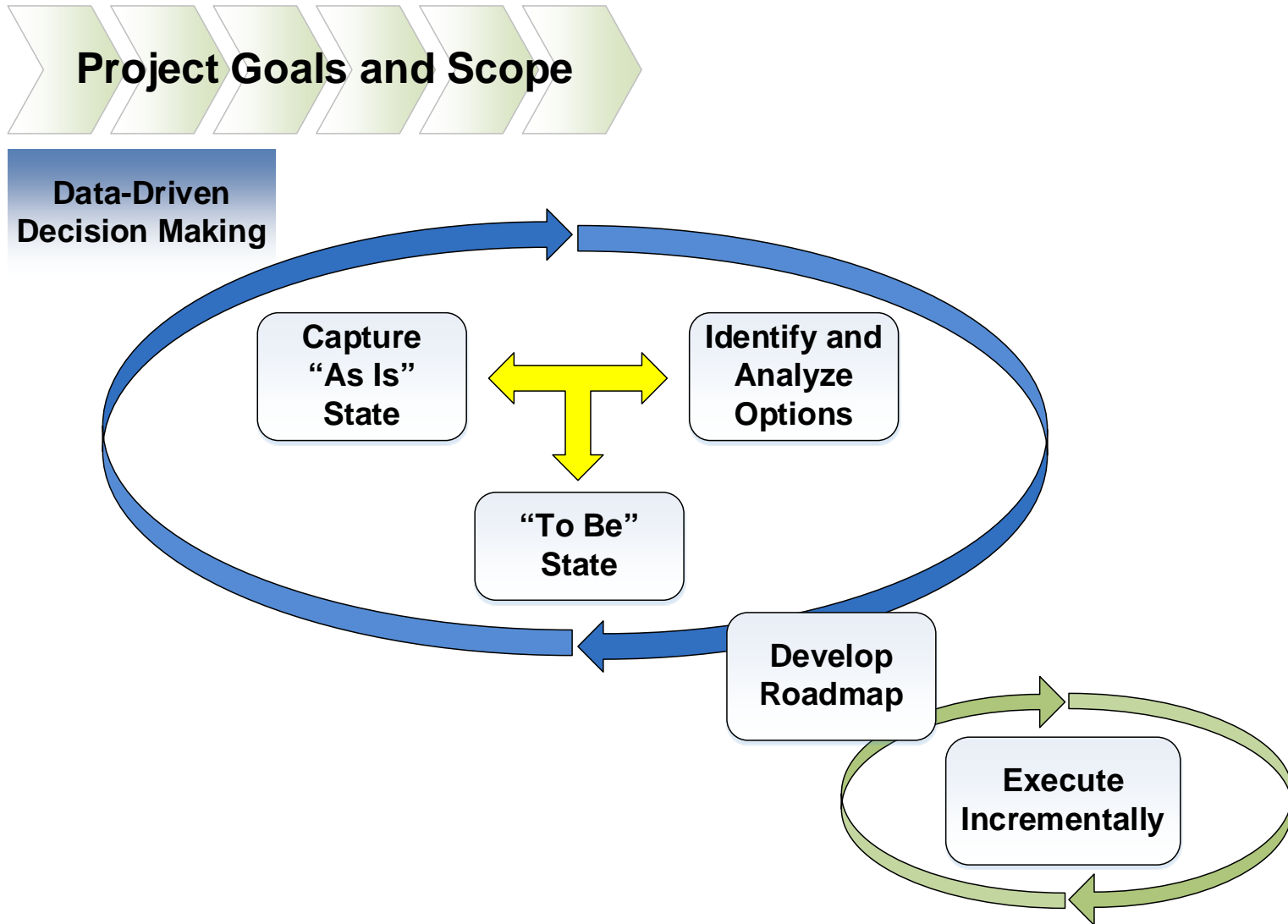
Prepare for or react to hardware or software obsolescence

Improve the user experience

*The federal government spent about 75 percent of the total amount budgeted for information technology (IT) for fiscal year 2015 on operations and maintenance (O&M) investments.*

– Federal Agencies Need to Address Aging Legacy Systems (GAO-16-468)

# A General Modernization Path - 1



Successful modernization projects generally follow a simple, incremental pattern to reduce execution risk.

Good decisions have a sound basis:

Business goals →  
Quality attributes →  
Technical decisions

# Next Steps?



# Contact Information

## James Ivers

Deputy Technical Director &

Architecture Practices Lead

Telephone: +1 412.268.7793

Email: [jivers@sei.cmu.edu](mailto:jivers@sei.cmu.edu)

## David Scherb

Program Development Manager

Telephone: +1 412.268.3946

Email: [dscherb@sei.cmu.edu](mailto:dscherb@sei.cmu.edu)